CALIFORNIA
OIL WORLD
and Petroleum Industry

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SECURALOY *Cuts* EXPLORATORY COSTS!

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Here is the way many operators doing exploratory work are cutting their costs and at the same time increasing the accuracy and safety of their testing operations.

When they drill into a sand with productive possibilities, instead of setting and cementing a string of casing and running a liner, they cement a combination liner and casing string made of "Securaloy." As illustrated (fig. 1), this string is cemented in place through ports in the casing at the top of the producing zone, using a basket below the ports, if desired.

By using a Security Left Hand Releasing Tool the operation is made extremely simple and positive, for this tool not only assures positive release but has a built-in packing device and tail pipe connection that facilitates the cementing operation. At excessive depths equalizing ports should be provided in the blank section of the string and a swab cup placed on the tail pipe to prevent by-passing of the cement through these ports during the cementing operation.

After the combination string is set the well is placed on production. If the sand proves productive, it can be produced as long as desired through the "Securaloy" Combination String.

But if the zone proves non-productive—or not sufficiently productive to warrant further development at the present—the entire combination can be quickly drilled up (fig. 2), circulated out of the hole, and the well completely cleared for further drilling operations!

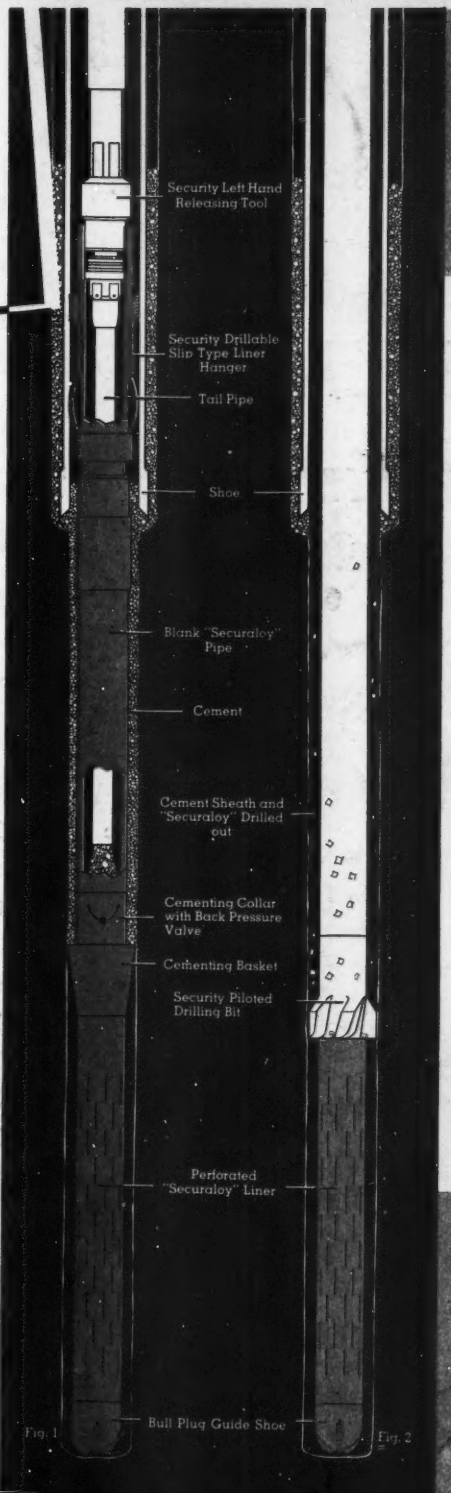
MONEY-SAVING ADVANTAGES

Notice the important savings which this method makes possible. In the first place, a full string of casing is saved each time a production test is made. That alone is an important economy.

But consider also that if the zone is non-productive the combination casing-liner string can be completely removed and the drilling carried on *without reducing hole size.*

And there is this additional feature—since the liner is part of the casing string, maximum size pipe can be used in the producing zone, assuring full *unchoked* production flow from the test sand—a vitally important point regardless of whether the zone is being fully produced or merely tested!

Full particulars on this or any other "Securaloy" application will gladly be sent upon request.



NO. 5 OF A SERIES SHOWING HOW "SECURALOY" INCREASES DEVELOPMENT EFFICIENCIES.

THE SECURITY *DRILLABLE* SLIP TYPE LINER HANGER

This liner hanger is similar to conventional slip type liner hangers except, being made of "Securaloy," it can be completely drilled up and circulated out of the hole whenever desired. It is ideal for supporting the combination liner-casing string described at left as well as for ordinary liner work where "Securaloy" equipment is used. It is available in all standard sizes, either with or without lead seal ring.

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Left to right: H. C. Smith, President of H. C. Smith Oil Tool Company, Al Kirkland, tool pusher, and H. G. Haney, Superintendent of the Thomas P. Pike Drilling Company.

Congratulations to

Thomas P. Pike Drilling C

on making outstanding drilling time on the

JOHN MARION NO. 2 WEL

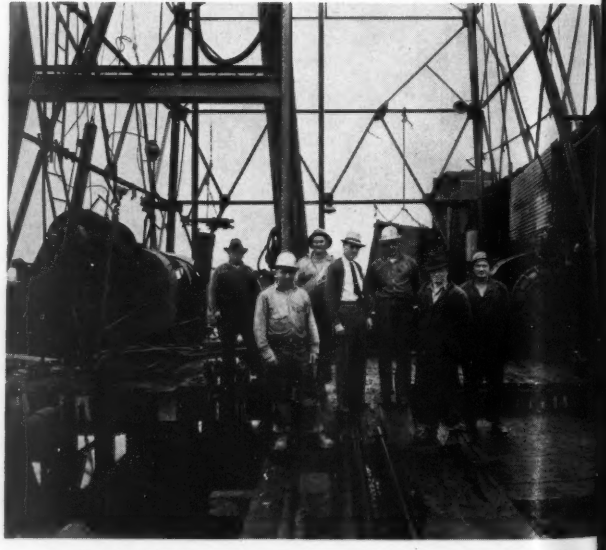
at Rosecrans

FROM 3040 TO 7600 FT. IN 17 DAYS WITH ONLY FIFTEEN ROCK BITS

of which thirteen were H. C. SMITH ROCK BITS

H. C. SMITH ROCK BIT

We are justifiably proud that our equipment played a part in the outstanding time made on this hole, again proving that YOU GET MAXIMUM PERFORMANCE WITH H. C. SMITH DRILLING TOOLS.



One of the drilling crews on the John Marion No. 2 Well at Rosecra which was drilled in outstanding time by the Thomas P. Pike Drilli Company. Left to right: Jim Hodge, G. H. Barnes, Art Eby, Eddie Hml representative of H. C. Smith Oil Tool Co., "Jeff" Jefferson, driller, L. Lynch and E. C. Truitt.

H C Smith Oil Tool Co.

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OIL WORLD
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May 25, 1939

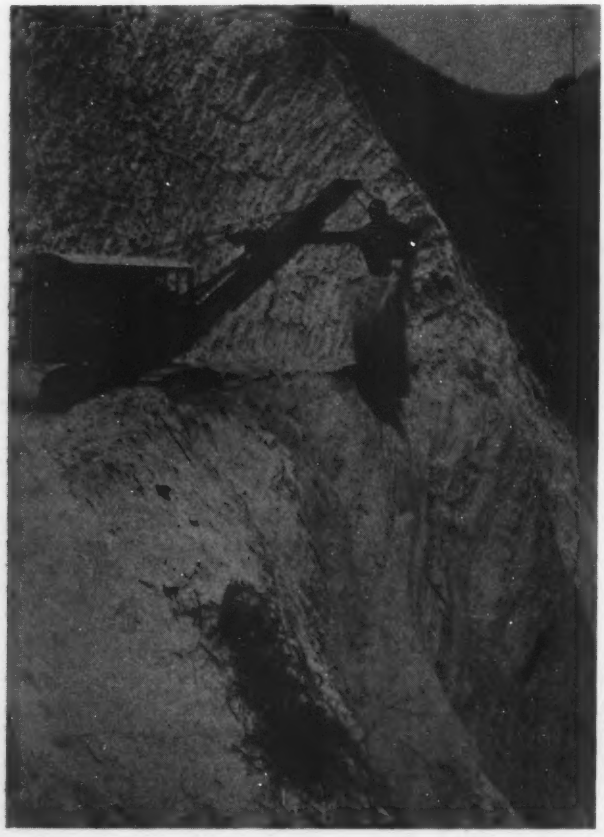
Telephone Number Richmond 2136

Conoco Builds Vertical Road In San Miguelito

Recent highly favorable results in Continental Oil Company's easterly development on the Grubb lease in the San Miguelito-Padre Canyon area have justified the building of a road in this difficult terrain. Cost of the road will be in excess of $19,000 although the length is only 5500 feet. Construction started nearly two months ago and work is expected to be completed in another two weeks.

At the lowest point on the road, elevation 250 feet, there is a steel bridge 106 feet long and 12 feet wide. Height of the bridge is 55 feet. With its six reverse turns and steep inclinations, the road offered numerous construction problems which were solved by ingenious methods. At several points it was necessary to lower the bulldozer down the steep sides by means of winch and cable.

The new road will serve five or six wells. Elevation of the discovery well in this easterly development, Grubb No. 5, is 986 feet. Grubb No. 13 will be about 700 feet below No. 5, and approximately 400 feet westerly. The wells in this area were brought in with an initial production averaging better than 2600 barrels a day. At this time Continental is reaming at 5597 feet in well No. 11, and rig is up for well No. 12.



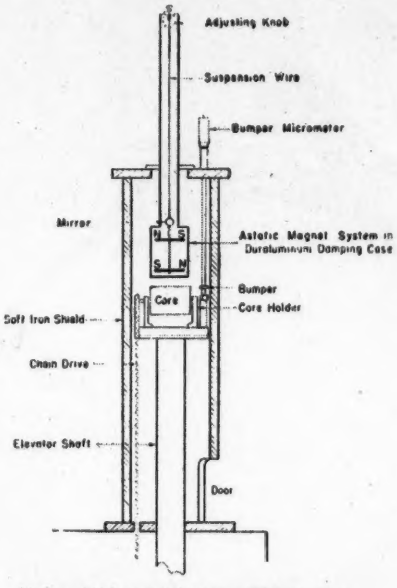
Field Equipment and Services Discussed

at Houston Oil-World Exposition

Technical and engineering features of oil field equipment and services were discussed by recognized authorities at the Oil-World Exposition in Houston, Texas, which recently closed a highly successful display of tools and materials which have made the 15 billion-dollar industry what it is today. The presentation of papers on the application of particular equipment and services was urged by oil company men and was carried out in a program passed upon by a Drilling and Production Committee headed by George B. Corless, of Humble Oil & Refining Co.

In his discussion of some defects found in hard-faced drilling tools, and their remedies, C. W. Metzger, Haynes Stellite Co., began with an analysis of an "ideal" drilling tool: a. Proper kind of steel for strength and ruggedness; b. proper kind of steel as base metal for hard-facing materials; c. properly shaped blades for easy penetration of formation, and drilling of straight, full-sized hole; d. proper size circulation holes, so located as to keep blades clean and remove cuttings rapidly, and protected from wear to prolong proper functioning; e. properly positioned tungsten carbide inserts, well bonded and strongly supported; f. final hardfacing layer to resist wear between inserts and along cutting and reaming edges, with tungsten carbide particles held in matrix offering maximum support; g. proper condition of steel portions of blades to offer maximum support to facing materials and maximum strength and toughness.

The steel composing the body of the bit, Mr. Metzger said, must, in addition to being of proper nature to be easily cast or forged and machined, have ample strength to transmit the driving power from the drill pipe to the cutting and reaming edges of the blades. The steel must possess sufficient toughness to resist breakage when boulders or irregular formations are encountered. It must also possess sufficient hardness to resist deformation and to support rigidly the tungsten carbide



POLAR CORE ORIENTATION INSTRUMENT

cutting elements. Drilling tool failures were ascribed to the following causes: a. Poor bond between original portion of blade of worn bit and rebuilt section; b. poor bond between base metal of blade and metal used to anchor tungsten carbide inserts; c. poor bond around tungsten carbide inserts; d. poor microstructure of steel in bit blades; e. poor microstructure of steel surrounding tungsten carbide inserts; f. poor microstructure of matrix metal around tungsten carbide grains in final layer; g. cracks.

In conclusion, Mr. Metzger said, "It is obvious that the commonest causes of defects in hard-faced drilling tools are the use of too much heat and failure to float off scale during the various welding operations, and the cracking of tungsten carbide by quenching following the heat-treating of the steel. A great deal of effort has been devoted to overcoming these conditions, with gratifying success."

M. E. Montrose, of Lane-Wells Co., presented a paper on the development and future trend of controlled directional drilling. In the period before the use of scientific and technical equipment in drilling oil wells, Mr. Montrose said, holes were drilled with the greatest rapidity in a race to reach the oil sand. In many of these wells pumping problems became acute and lifting costs inconsistent among wells in the same field drilled at the same time. Likewise, off-setting wells drilled to similar measured depths for some unknown reason failed to reach the common oil sand.

With the introduction of well course surveying instruments, it was discovered that hundreds of oil wells in California and Oklahoma had been drilled many degrees off the vertical. The industry then realized that "crooked holes" with the attendant horizontal drift and vertical depth correction, explained many of the variations in neighboring wells. After discussing the deflecting tools and applications in remedying "crooked hole" problems, Mr. Montrose pointed out that the part the human element plays in directional drilling is oftentimes not fully appreciated by operators who have never had occasion to use the services of a trained directional drilling crew. Particularly in the case of using deflecting tools, the directional driller must have rotary drilling experience and the ability to supervise a regular drilling crew, as well as have an understanding of algebraic and trigonometric functions and a specialized training in using deflecting tools under varying well conditions.

"Many advancements," Mr. Montrose said, "will undoubtedly transpire in the scientific and economic development of controlled directional drilling in the future drilling of wells. It will be interesting to see in what manner controlled directional drilling shall find its final acceptance, under the many changes and improvements in drilling procedure . . . . Underground spacing of well locations as compared with surface locations, the consideration of allowables based on sand thicknesses, allowables based on exposed areas of bore holes, and other plans which may be presented for basing well potentials, allowables, and ultimate recovery will develop other applications of controlled directional drilling."

A contribution to the program was a paper prepared by Eastman Oil Well Survey Co. engineers, covering the application and procedure of controlled directional drilling. The authors say that controlled directional drilling as commonly undertaken in present day practice usually falls in one or two general

ELECTRICITY AT WORK IN THE OIL FIELDS

Modern electric "direct current" drill rigs are setting drilling records for speed, efficiency and low costs in some of the toughest formations in the country. The deeper the hole, the tougher the going, the better the new electric rigs like it. They give the driller more power, better torque control, smoother and easier operation. No other type of drilling power provides such absolute control.

The first cost of the new electric rigs is comparable with the cost of other types, and maintenance and operating expenses are lower. If you haven't heard about the performance of "direct current" drilling rigs, get the facts from an Edison power engineer. He will call at your request. Telephone your Edison office.

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classifications: 1. The New Location, where control of drilling to a predetermined point is desired, and 2. The Redrilling of Wells, where a correction in the natural course of a drilling well is desired.

The New Location embodies such problems as: a. The drilling of relief wells; b. drilling of wells under inaccessible surface locations; c. multiple wells in offshore marine locations, and d. for geologic exploration.

The Redrilling of Wells presents many adaptions of controlled drilling such as: a. correction of drift and direction to maintain low drift angle; b. correction of drift and direction to prevent trespass; c. to direct course of hole under a salt dome overhang; d. to direct course of hole to productive side of fault zone; e. to direct course of hole away from edgewater into production, and f. in sidetracking lost tools and recompleting wells to known productive horizons.

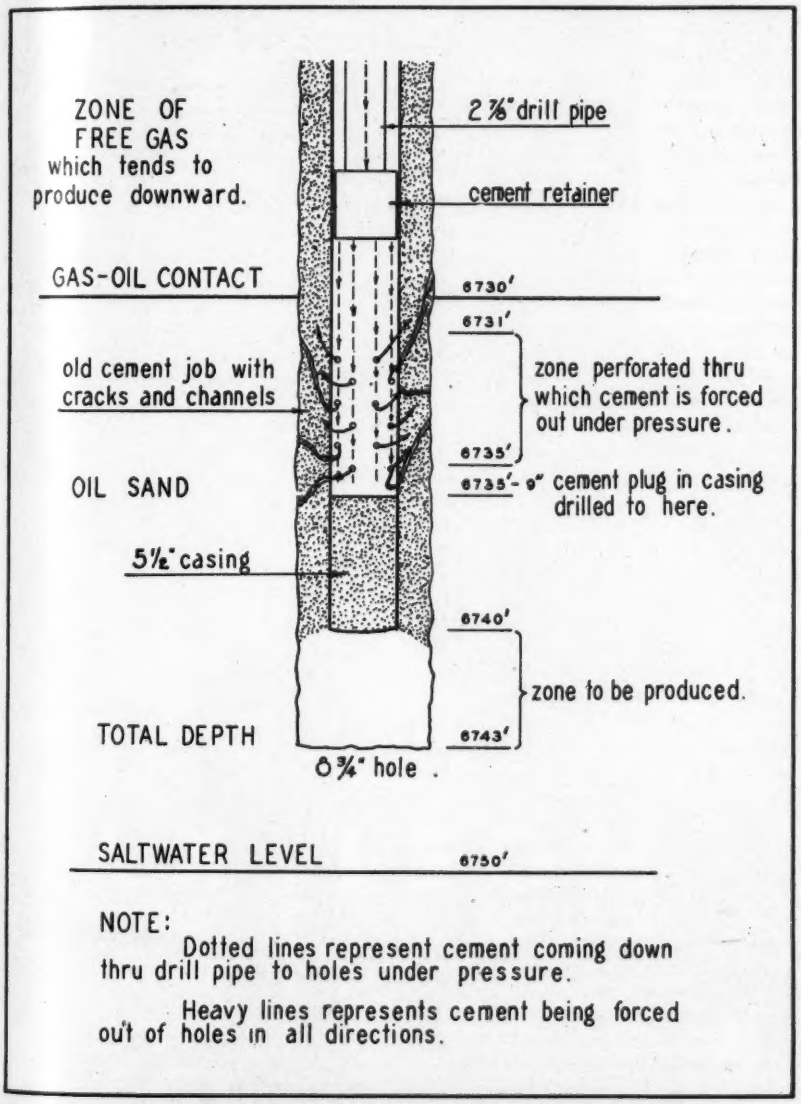
The Eastman engineers point out that informative surveys are those usually executed upon the completion of the drilling of a well and are obviously of great advantage to the operator. From the standpoint of practicability the advantages are listed as follows: 1. The knowledge of true vertical depths of geologic horizons. 2. Knowledge of the actual position of the well on the structure. 3. Aid in geologic correlation and structural contouring. 4. An accurate base from which to plan corrective drilling. . Accurate knowledge of the wells position in the reservoir in such considerations as well spacing and determination of yield and valuation.

James V. Robinson, of Technical Oil Tool Corp., Ltd., presented a paper on controlled vertical drilling methods. The introduction of the weight indicator and precision deviation recording instruments, simple enough to be operated and interpreted by the driller, the author says, provided the necessary basis for the final and absolute establishment of the principles and methods of modern controlled vertical drilling. In both controlled vertical drilling and controlled directional drilling, identical principles of control are utilized. The main factors are the influence of the pendulum force of the drill string under tension, and its flexing under compression.

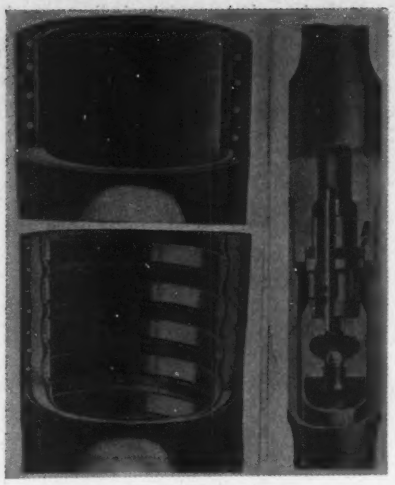
The author states that the physical forces acting on the bit can be controlled to maintain a vertical course by proper regulation of drilling weight and rotary speed. This accomplishment, he says, requires but two essentials: The driller should be provided with a reasonable drilling "set up" including a bit appropriate to the formation, and in good cutting condition, an average length (30′ to 90′) drill collar and a string of drill pipe suitable to the size of the hole being drilled. The driller must also have a precision deviation recording instrument. It should be run often enough to inform him immediately when the first deflection begins so that he can readjust his weight and speed to halt this deviation before the other adverse factors of instability, eccentric rotation, and lateral bit forces become established.

Lane-Wells' M. E. Montrose came through for the program committee with a second contribution in which he discussed the gun perforator in drilling-production problems. Among the first successful devices contributed to obtain really scientific knowledge of sub-surface conditions, the author says, were the electrical logging devices, the formation tester, and well surveying instruments. It became possible to plot correlation curves of formations from new wells to old wells in the same field, eliminating the uncertainty connected with the reconditioning of old wells.

However, says Mr. Montrose, one great obstacle remained in the way of a complete and profitable application of the new geological knowledge available. This final obstacle was the difficulty of perforating casing underground, accurately and getting to formation without splitting casing or breaking the bond between cement and casing or cement and formation. The objective was to produce a device which would assure accuracy and flexibility in the spacing of holes, and with sufficient power to penetrate two or more cemented casing strings and reach virgin formation. Safety was of paramount importance. The device developed to meet all of the requirements is now known as the "gun perforator."


ZONE OF FREE GAS which tends to produce downward.
2⅞" drill pipe
cement retainer
GAS-OIL CONTACT
6730′
6731′
old cement job with cracks and channels
zone perforated thru which cement is forced out under pressure.
6735′
OIL SAND
6735′- 9" cement plug in casing drilled to here.
5½" casing
6740′
zone to be produced.
TOTAL DEPTH
6743′
6¾" hole .
SALTWATER LEVEL
6750′
NOTE:
Dotted lines represent cement coming down thru drill pipe to holes under pressure.
Heavy lines represents cement being forced out of holes in all directions.

Diagrammatic Sketch Showing Typical Squeeze Job to Improve Gas-Oil Ratio, as Performed Before Original Well Completion



Left: Neoprene lining simplifies oil hose construction. Right: Neoprene bearing at "A" permits the use of mud, water or oil as a lubricant in this core barrel.

"While some of the mechanical requirements for a successful gun perforator are realized," Mr. Montrose says, "it is not generally realized the tremendous amount of research represented by (1) electrical detonation of gun powder thousands of feet in the ground, (2) the selective firing technique which makes possible successive discharge of individual shots, which also protects the casing from mechanical troubles, (3) the discharging of steel bullets with sufficient velocity to secure penetration of multiple strings of steel casing and cement, (4) design and physical properties of alloy steel bullets to provide sufficient strength for tremendous pressures built up by gun powder explosions, (5) the correct shape of steel bullets for penetrating steel, (6) the positive means of excluding fluid under high pressures, and (7) the suitable weight suspending and current carrying methods necessary to insure complete surface control. These things are only indicative of the complex problems involved in perfecting the gun perforator which today has been accepted as a commonplace tool of the oil industry.

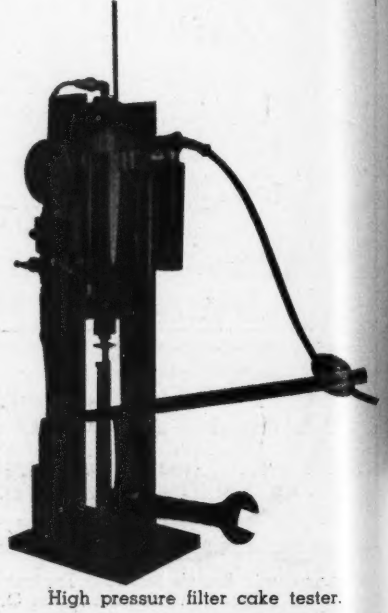
"The special mobile equipment, built and equipped with wire lines, line spoolers, electric generators, guns, chambers, etc., is indicative also of the combined engineering knowledge and experience required to make such a universal service available . . . . If a figure could be arrived at showing the oil production obtained by the gun perforator in cased-off wells in zones which perhaps may never have been included in estimated oil reserves, it no doubt would surprise the oil industry. It is encouraging to realize that the millions of barrels of oil now lying behind casing in upper strata can be produced economically by the many applications of the gun perforator," Mr. Montrose concludes.

Otto Hammer, of Security Engineering Co., Inc., presented a paper on the properties and use of "Securaloy" as applied to oil well production. This recently developed drillable metal is obtainable in various pipe sizes as well as in the form of heavy wall extrusions, forgings, bar stock and castings. It possesses, the author states, mechanical properties which enable it to be fabricated into most any desired type of structure with ample strength for subsurface use, but has the distinction of being readily drillable which allows it to be removed from a well by means of a drilling bit. The low specific gravity of the metal and the small chips formed in drilling up make it possible to remove the cuttings from the well by the return circulation fluid. The drillable pipe is frequently gun perforated. The seamless drillable tubes, etc., are subjected to two separate heat treatments, one of which permits recrystallization to take place to remove working strains, and the other is an aging process which develops the maximum strength in the material.

Mr. Hammer describes a new application of drillable material thus: A recent development in the adaption of drillable material to meet production repair problems has been the installation of drillable pipe sheaths or "scabs" placed inside of existing liners or casing. The purpose of these "scab" sections is to sheath cut-out screen perforations or blank off a specified section of existing liner perforations to alter the well's gas-oil ratio. To accomplish this type of work, two drillable lead seal packers are spaced a predetermined distance apart by means of a connecting section of drillable pipe of the largest diameter possible. Means are provided to set each of these packers independently of the other without the necessity of more than one trip in the hole. The complete assembly (packers and connecting pipe) is run in the well as a unit to a point which will place the packers above and below the section of casing or liner which is to be sheathed, thus leaving the drillable pipe opposite the steel section to be protected. In some cases, after the lower packer has been set, cement is forced between the "scab" pipe and the liner to form an additional packing bond. The top packer is then set and the run-in tools withdrawn from the hole. An example of the results obtained from this method is found in the production log of a well which had "cut-out" liner perforations and was producing from 10 to 15 percent fine sand. While in this condition, the well was shut down for cleaning and pump repair purposes for 59 days out of a total elapsed time of 220 days or about 39 percent. Since the "scab" has been placed in the well, and during a ten-month period, the production flow has been constant with less than 0.3 percent sand content and no shut-down time.

Internal Tubular Inspection Service, inventors of a device for examining interior pipe surfaces, contributed a paper describing the equipment used in their work. The Tuboscope consists primarily of a system of lenses set in tubes lined with oxidized brass. A light source and angle mirror are located at the anterior end and a focusing eyepiece is at the posterior end. When moved through the tubular article being inspected, two images are apparent, an annular image and an angle mirror image. Before inspection the surfaces to be viewed are thoroughly cleaned.

In the field report which the operator prepares after finishing each job, the quantity of work done and identification of the articles Tuboscoped is noted, followed by a description and enumeration of the defects observed. Defective joints are marked with paint, and the color markings are clearly explained in the report, red signifying cracks, green signifying fluid wear or washes, yellow denoting too great makeup at tool joints or collars, white designating the presence of pits or corrosion, blue denoting the presence of mill defects, and orange signifying that a defect due to handling of pipe is present, such as a torch cut or dented seal area. A statement as to the internal condition in general of the string of pipe, kelly, etc., is made, and when requested, is followed by a suggestion as to repair or condemnation



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2. Testing liners for facing and surface defects.

3. Testing liners for length.

4. Dial gaging for uniformity of bore.

Every link in the long chain of operations that end in Axelson liners is given the "Go" and "No-Go" inspection. ¶ From the very beginning, in the specially built and specially equipped Axelson foundry, the quality of four kinds of pig iron, six or more kinds of alloys, various grades of steel and fourteen other products, is determined by actual chemical analyses that in every case result in "Go" or "No-Go." ¶ The making and baking of cores—the mulling of molding sand—the construction of the molds—the size of gates and risers—the pouring temperature of the metal—all are controlled by "Go" and "No-Go" standards. ¶ Throughout the many manufacturing operations, including boring, grinding, pressure testing, honing, facing and polishing, with the correct heat treatment according to the type of liner being made—every step means approval or rejection according to rigid "Go" or "No-Go" tests. ¶ It might seem that these progressive manufacturing operations and inspections would be enough to guarantee perfection in the finished liners. Axelson thinks they are not. Axelson must *know* that every liner is absolutely exact as to inside and outside diameters—absolutely the same length as every other Axelson liner—absolutely true as to square, air-tight faces—and absolutely uniform through the entire length of the bore. ¶ In every language, Axelson means excellence.

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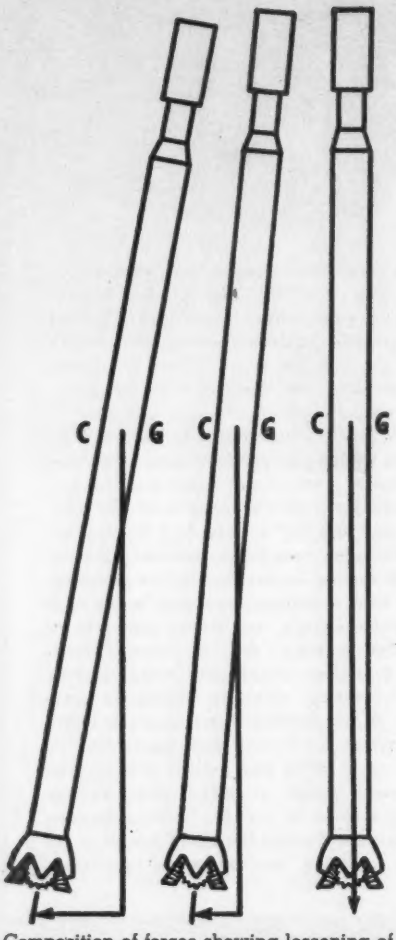
THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY



Composition of forces showing lessening of effective drilling weight through introduction of lateral forces arising from inclination of the hole. The length of the horizontal line represents the magnitude of the lateral force on the bit.

of the particular points marked. Pictures of defective areas are submitted with the report in order to give a more complete explanation of the report.

An outline of the general points that are observed by a Tuboscope operator in the course of a typical inspection of drill pipe is presented in the paper as follows: In the upset area of the pipe: a. The makeup of tool joints, and distance between singles at the collar. (Tool joints made up too far on the pipe, and singles closer than 5/8" at the collar in doubles are marked). b. Thread washes. (Circulation cuts between tool joints and pipe, and collars and pipe are marked). c. Washing, wrinkling or mill defect. (Those which would weaken upset proper or taper of upset are marked). d. Cracks in upset.

In the body of the pipe: a. Seams or overlaps. (Crevices beneath overlaps may be deep, and also may obstruct circulation to the extent of causing a washout). b. Pits. (Pits are judged according to their location, arrangement and depth. Single pits 25% or more of the body wall thickness in depth are sufficient to weaken pipe, as they not only are liable to give direct rise to a washout, but are also very vulnerable to fatigue cracks. A number of pits 15% to 20% of the body wall thickness in depth which are located in a particularly vulnerable spot such as near the upset area but in the body of the pipe, should be checked). c. Corrosion. (Experience enables the operator to tell when corrosion has progressed far enough to condemn pipe). d. Washes. (The depth and abruptness of edges of a wash must be considered in judging the potential and actual harm to result from the wash). e. Cracks. f. Internal cutter marks, or any other detrimental features observed are marked.

Dwight C. Roberts and E. Ray Webb, of Sperry-Sun Well Surveying Co., in their discussion of polar core orientation present a highly interesting story of the development of a method for ascertaining the true dip of formations or fault planes by study of the residual polarity in formation cuttings or cores. In their introduction the authors say:

"The orientation of bore hole cores has long presented a problem to the oil and mining industries, which until recently could not be solved without considerable loss of time during drilling operations. Neither was it possible to orient cores by any method after they had been removed from the hole until the advent of Polar Core Orientation."

While working with a magnetometer survey party on the east side of the San Joaquin Valley, H. N. Herrick and Edward D. Lynton, of Standard Oil Co. of California, observed that the vertical intensity balance had been giving very high readings in that area. Upon discovering an outcrop of highly magnetic gabbro nearby, they broke off a piece and held it against the north end of the magnet system of the magnetometer and noted that the needle reacted in one direction, while, upon turning this sample over and offering the other side to the needle, a deflection in the opposite direction took place. From this experience it occurred to Mr. Herrick that if an instrument sensitive enough to determine the direction of the infinitesimally small fields in rock found by the core drill could be developed, it would be possible to determine direction of formation dips and fault planes.

The first machine to determine the residual polarity in mineral grains of sedimentary deposits was built by Standard of California in 1928 and in the succeeding nine years new machines incorporated vast improvements. In 1937 the Sperry-Sun Well Surveying Co. acquired exclusive license from the Standard company to commercialize Polar Core Orientation on a world-wide basis and built a self-recording mechanically-operated instrument incorporating all of the latest developments that the Standard Oil Co. had made up to that time, as well as many refinements in construction and operation of its own.

The authors cite the following examples of benefits derived from core orientation: An oil company was drilling an exploratory well on the axis of a structure. Upon reaching a depth of approximately 5,000 feet, cores indicated a sudden increase in formation dip. Polar Orientation of the cores showed that the high of the lower structure was in an easterly direction from the surface high. The hole was plugged back and directed easterly. Continual coring and Polar Orientation of cores during this directional drilling operation enabled the company to drill to the high of this structure and then direct the hole vertically downward on the axis until the oil sand was encountered. This well was completed in oil sand at a depth of 5,500 feet, approximately 750 feet east of the surface location.

Faults in several proven fields have been determined by Polar Core Orientation, thus assisting materially in the development program in these fields. Many cores from exploratory core holes have been oriented, rendering information which has assisted in proving or disproving geologic structures. This method of core orientation, the authors say, is in its infancy as far as general utilization is concerned. As time goes on as the oil and mining industries become better acquainted with its advantages, they believe that Polar Core Orientation will become common practice to assist in solving all problems involving determinations of direction of formation dips and fault planes in geologic structures.

An interesting paper, uncredited as to source, discusses core drills applied to oil field service. The modern fast portable core drill has now been developed to the point where it is not only a tool indispensable to a geologist for extracting cores and drilling electric logging holes and to the seismograph surveyor for drilling shot holes, but, on account of the trend toward slim hole drilling, a tool invaluable to the production man for small hole production drilling, the paper sets out.

The modern drill of this type constitutes a complete drill rig, and includes the following features, the paper continues: A multiple speed reversible rotary table with or without an automatic chuck but with a retractable hydraulic feed mechanism that is utilized in hard formations when encountered close to

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the surface, but is retracted when feeding off the line. A mud pump of adequate capacity. A multiple speed drawworks. A universal type transmission. A conveniently located cathead. Adequate power units, either gasoline or diesel engines, or in the smaller machines a power take-off drive from the truck engine. An automatically elevated and lowered mast or derrick with suitable crown block. A separate high speed sand reel is included on some of the larger machines. This entire outfit is mounted on a suitable motor truck or automotive type trailer.

D. O. Johnson, of the S. M. Jones Co., discussed modern sucker rod pumping. Developments, he says, have made available several instruments now used in the study of pumping wells. The most useful for practical every day guidance is the perfected polished rod dynamometer. The most common types in general use being the Kemler well-weigher or electric type; the Martin-Decker hydraulic type, and the Westinghouse or mechanical type of instrument. The Gilbert-Sargent sub-surface dynagraph is used in measuring the load and stroke at the pump and in determining the effectiveness of the pump itself.

The static and pumping fluid levels in a well are important considerations in perfecting efficiencies of a pumping well, the author says. Two devices are available for measuring the fluid level during operation, one known as the Depthograph, and one the Echo Meter. As correlating data for fluid level measurements, it is important at times to measure the bottom hole pressures. There are four principal types of bottom hole pressure bombs or gauges, namely, the Amerada, Gulf, Humble, and I.T.I.O. gauges.

Corrosion is such an important factor in the cost of producing some pumping wells that it would be very advantageous, Mr. Johnson says, if ways could be developed to classify such wells by means of measurements with instruments in the field. This type of well requires special higher priced equipment designed to withstand corrosion better in order to be economically run. The measurement of electrical potential between polished rod and tubing established the presence of a motivating force for displacements of metal and bad pitting. Some work of this nature is now being done, as in the case of oscillograph studies when the electrical polished rod dynamometer is used as a galvanometer in recording the changes of electrical potentials throughout the stroke. There are other simple instruments which can be used in studying a pumping well such as indicating and recording tachometers, stroke-counter, stop watch, etc. It is pointed out that the dynamometer card is of little value until coordinated with other factors.

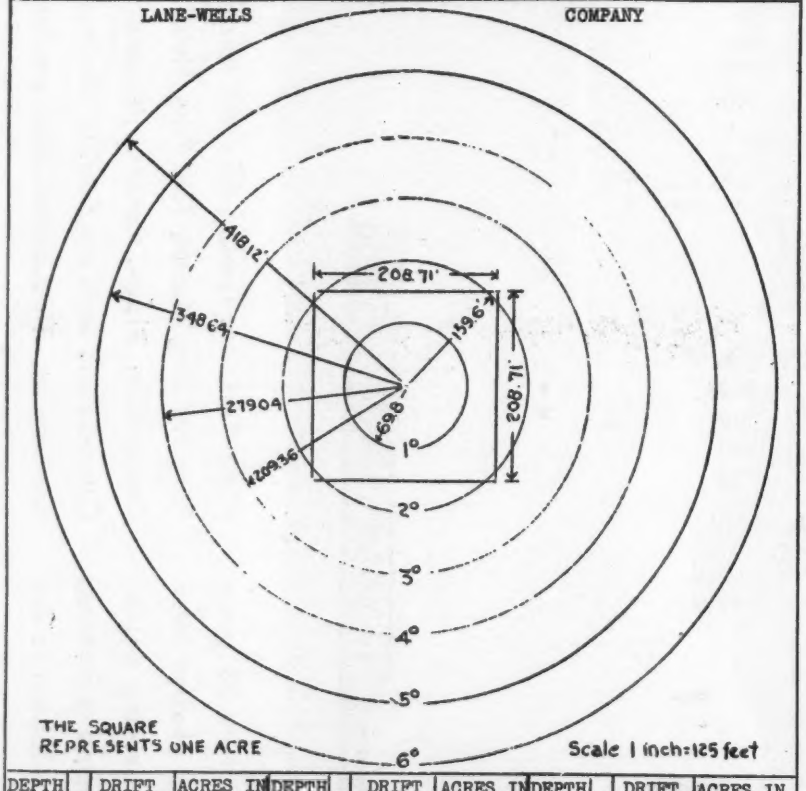
One of the most common causes of excessive rod failures, the author says, is overload. An overload condition may be caused by water encroachment, by using a pump which has too many cups or rings for the operating conditions involved, abnormal restrictions down the hole. In one case the number of rings on the plunger was reduced from 30 to 7, reducing the load 6000 pounds without affecting production rate and eliminating failures. In another case the tubing was improperly set on the catcher in a 6000-foot well. After the top of the tubing had been pulled up 3½ feet the load was reduced 8000 pounds.

High beam pumping costs can, the author points out, be caused by lack of equipment efficiency. This covers wells where rod stretch defeats plunger travel, where pump displacement is too large for available fluid; where subsurface equipment is improper to the fluid conditions, and where low fluid recovery is due to improper pump action. In studying under-travel of plungers the bottom hole pump dynagraph has been invaluable in proving the definite correlation between a polished rod dynamometer card and a condition of plunger undertravel.

P. E. Loye, of Reda Pump Co., described the construction and operation of the company's submergible electrical centrifugal oil well pumping units. The pumping unit consists of the multi-stage centrifugal pump direct connected to the motor through a "protector" section, the

CHART SHOWING AMOUNT OF HORIZONTAL DRIFT AT A DEPTH OF 4000 FEET.

LANE-WELLS COMPANY

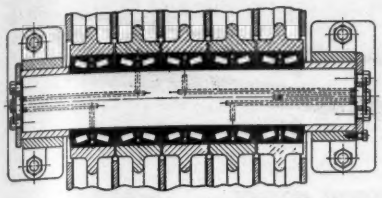


THE SQUARE REPRESENTS ONE ACRE

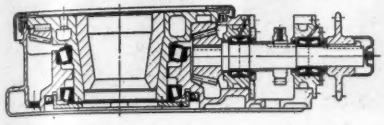
Scale 1 inch=125 feet

DEPTH	0°	DRIFT IN FEET	ACRES IN CIRCLE	DEPTH	0°	DRIFT IN FEET	ACRES IN CIRCLE	DEPTH	0°	DRIFT IN FEET	ACRES IN CIRCLE
1000'	1	17.45	0.02	4000'	1	69.80	0.35	7000'	1	122.15	1.08
	2	34.90	0.09		2	139.60	1.41		2	244.30	4.30
	3	52.34	0.20		3	209.36	3.16		3	366.38	9.68
	4	69.76	0.35		4	279.04	5.61		4	488.32	17.20
	5	87.16	0.55		5	348.64	8.75		5	610.12	26.85
	6	104.53	0.79		6	418.12	12.61		6	731.71	38.61
2000'	1	34.90	0.09	5000'	1	87.25	0.55	8000'	1	139.60	1.41
	2	69.80	0.35		2	174.50	2.20		2	279.20	5.62
	3	104.68	0.79		3	261.70	4.94		3	418.72	12.64
	4	139.52	1.40		4	348.80	8.77		4	558.08	22.46
	5	174.32	2.19		5	435.80	13.70		5	697.28	35.07
	6	209.06	3.15		6	522.65	19.70		6	836.24	50.43
3000'	1	52.35	0.20	6000'	1	104.70	0.79	9000'	1	157.05	1.78
	2	104.70	0.79		2	209.40	3.16		2	314.10	7.12
	3	157.02	1.78		3	314.04	7.11		3	471.06	16.00
	4	209.28	3.16		4	418.56	12.64		4	627.84	28.43
	5	261.48	4.93		5	522.96	19.72		5	784.44	44.38
	6	313.59	7.09		6	627.18	28.37		6	940.77	63.85

entire assembly being of small diameter so that it may be run in wells cased with small diameter pipe. The unit is suspended on tubing in a manner similar to a working barrel, with a cable extending



Bearing system in traveling block.



Bearing arrangement in rotary table.

from the surface to the unit to carry electricity to the motor. The pump is a vertical assembly of centrifugal impellers and diffusers of the required number, type and diameter to produce the desired volume against the required discharge head. As many as 317 stages are put in a single pump and even then the length is but 25 feet.

Mr. Loye lists unique features of this equipment as follows: Power is transmitted electrically to the point from which the fluid is to be lifted. Corrosive fluids do not materially affect the unit since the motor is sealed from contact with the well fluid and pump parts are of corrosion-resisting materials. Current maintenance keeps the pumping unit in 100% operating condition at all times since all wearing parts can be replaced each time repairs are made. The unit can operate satisfactorily in a crooked hole. Tubing as small as 1¼ or 1½-inch can be economically used since tubing may be selected from a consideration of efficient flow only. The unrestricted tubing string minimizes paraffin deposition and permits simple, automatic removal with a paraffin scraping go-devil. Emulsion is reduced due to continuous flow through the pump and the absence of valves or cups. Since there are no moving parts above ground, the well is operated by a push button or a clock switch and operating labor required may be reduced to that needed for gauging and running the oil. No foundations are required. A tubing job installs the unit. Depth does not affect the amount of power which can be delivered to the pump.

R. S. Kail, of Baker Oil Tools, Inc., spoke on squeeze cementing before production to reduce gas-oil ratios. Before any attempt is made to produce a well, operators can usually determine the probable necessity for squeeze cementing to reduce the gas-oil ratios by testing cores, checking electrical logs, or by operations on discovery or problem wells and can proceed by methods that have been demonstrated successfully, the author says. The paper presents the feasibility of placing an artificial cap of cement in the absence of a natural division of the gas and oil bearing formations, and particularly to do so shortly after cementing the casing during the time usually allowed for cement to set around the casing. The information is based on 110 squeeze operations on 95 wells which are representative because all wells are included on which information was available, but probably does not include more than 30% of the total wells squeezed for the reduction of the gas-oil ratio.

The placement of an artificial cap before initial completion, the author says, conserves gas in the underground reservoir for longer flow life, and eliminates the complications due to coning over the face of the oil zone. Squeeze cementing before production to eliminate high gas-oil ratios should be effected on all wells that do not have some relatively impermeable cap more than three feet thick dividing the gas bearing formation and the oil bearing formation. Without this thickness, the gas evidently acts on the cement around the casing to reduce its effective strength, perhaps preventing any set whatsoever.

"There are good and sufficient reasons," Mr. Kail says, "why a cement retainer will successfully squeeze-cement a well where other methods so far have failed. 1. Gas can be safely and effectively killed with water before cementing. This is imperative as cement has not set when charged by gas. Although it has been tried repeatedly, I have not found a single instance where a producable gas-oil ratio resulted by closing the rams and squeezing part of the cement into formation on a casing job, probably for many reasons besides the action of gas on cement, and the low operable pressures. 2. The pressure held by the retainer on the placed cement increases the setting strength of the cement. (Not its initial setting time). If water is first squeezed and then cement by the bradenhead method, pressure cannot be positively maintained on the placed cement, due to change in volume of casing fluid caused by temperature, as well as the elasticity of the fluid cushion. 3. The cement Retainer permits the use of higher pressures than are otherwise possible or advisable. 4. The Retainer prevents misplacement of cement around the tubing due to casing leaks above the cementing point.

"To prevent any cement getting outside the tubing when using the cement Retainer in conjunction with squeeze cementing, I suggest the application of sufficient pressure to the casing, before opening the valve in the circulation joint, that will surely raise the extra cement out of the tubing. If nothing fails at this pressure, then open the tubing immediately above the Retainer by lowering the circulation joint and cement starts up, no cement gets outside the tubing. If sufficient pressure is not available, due to mechanical difficulties, the cement may set inside the tubing, but this is not comparable to leaving the tubing cemented in the well. Cement that sets only inside the left hand back off nipple does not have sufficient strength to prevent unscrewing from a Retainer.

"The cost of a squeeze job before production is approximately $850. This cost after completion (workover) is $3000 minimum on this type of well, due to the cost of killing the well, moving in equipment, extra Retainers for bridge plugs, new liners, loss of production, etc."

H. C. Yarbrough, of Yarbrough Guns Co., discussed locating water entries in oil wells by electrical means. The author says that production of water is the greatest single hindrance to economical production of an oil well, and classifies wet wells thus: Wells in which the water is coming from the producing stratum itself, and wells in which the water source is an individual stratum, either a water sand or a depleted oil sand. In correcting a water condition in any oil well, the first step is to determine definitely the exact point or points of water entry. To make this determination there have been developed many types of water locating devices, some employing strictly mechanical means, others of an electro-chemical nature, and still another type employing electrical principles.

In the electro-chemical method of locating water, a relatively strong wet-cell is made of the portion of the hole to be tested by: 1. The even distribution of sufficient concentrated electrolyte to raise the potential value of the fluid to about four times what it could possibly be under natural conditions. This procedure is called conditioning. 2. The lowering into the well of two dissimilar elements (metals) connected to the end of an electrical conductor cable. When the elements enter the portion of the well containing water or mud, current flows from one metal to the other through the solution. This flow increases when the elements enter the conditioned fluid. The voltage of this flow is measured at the surface by a millivolt meter.

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The entrance of water from the formation is encouraged by reducing the hydro-static pressure on the formation. Incoming formation water, being relatively poor electrolyte, reduces the electrolytic value of the conditioned fluid by dilution at the point or points of water entry. This causes an abrupt drop in the voltage output registered at the surface when the elements of the wet-cell enter a diluted area, and an abrupt increase when they leave the diluted area and re-enter the undiluted conditioned fluid. Since the exact depth of the wet-cell elements is known at all times, it is possible to determine the exact point or points of water entry.

O. D. Treiber, of Hercules Motors Corp., discussed the diesel engine in oil field service. The interest with which this paper was received by the oil men, from roustabout to superintendent, is indicated in the following excerpts:

"The Diesel engine usually has a compression ratio of about 15 or 16 to 1 where the pressure and temperature at the end of compression is about 500 lbs. and 1000° F., respectively. Adequate provision is made in the design and construction of the modern Diesel to withstand these heavier pressures. . . . Gasoline and natural gas engines mix the fuel with the air on the outside of the cylinder, and the carburetor, induction manifold and inlet passageways all contribute to the mixing of the fuel and air, so that when the spark occurs the mixture is quite uniform, but in a Diesel only air is compressed and the fuel has to be mixed with air in a very short space of time. To merely inject the fuel into the combustion space is not enough. The high speed Diesel engine has to have some mechanical means of mixing the fuel with the air in the cylinder. This is the crux of Diesel engine design. Myriad ways have been proposed and built to perform this function. Hercules' method is by arranging a spherical chamber on the side of the cylinder into which the air in the cylinder is driven tangently to the sphere, thus giving the air in the sphere a revolving motion, the velocity of which is proportional to the speed of the crankshaft. . . . The velocity of air into the sphere reaches a speed of 15 miles a minute at 2000 RPM and the air revolves in the sphere at 50 times crankshaft speed, regardless of engine speed. At 1500 RPM the air revolves at the rate of 75,000 times a minute.

"The fuel is injected into the cylinder through a pintle type of nozzle by a plunger pump. A pump for each cylinder and all pumps for an engine are mounted into a common housing which includes the camshaft for operating the pumps. A governor, built integral with this pump assembly, controls the speed of the engine by feeding more or less fuel through the nozzles to meet the power demands. The cylinders always take in the same amount of air, regardless of the power output."

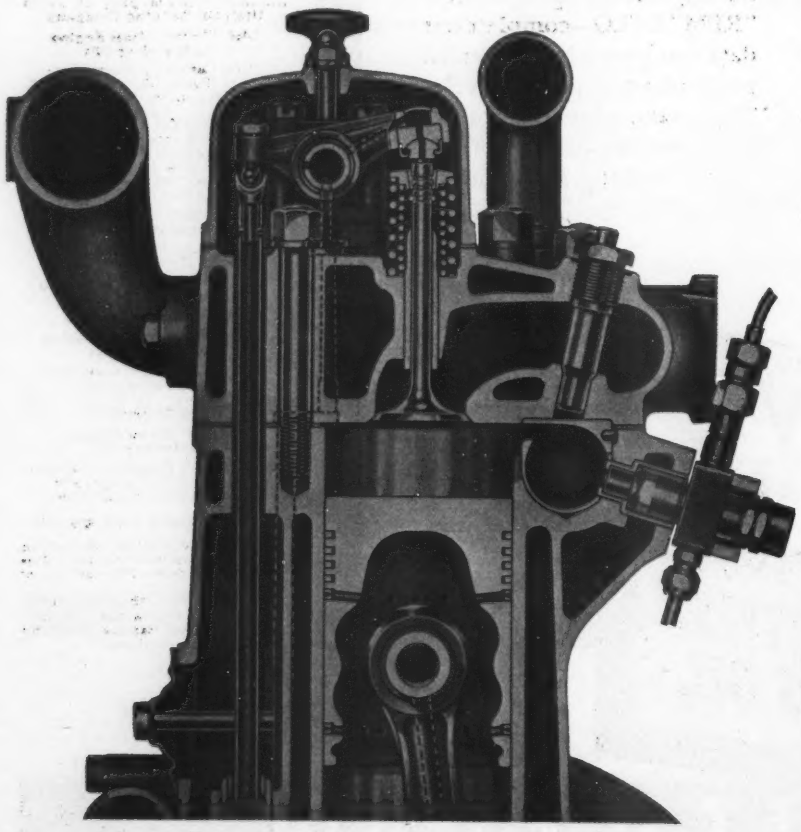
Among the advantages listed for diesel engines are much higher fuel efficiency, lower cost of fuel, elimination of electric spark hazards, lower cooling water requirement, high continuity of power rating.

The discussion of air cleaners for oil field engines, presented by C. C. Sowerby, of American Air Filter Co., brought out a number of significant facts not generally enough realized by engine operators. The displacement of a 250 hp 2-cycle pump scavenged engine, Mr. Sowerby says, is approximately 1500 cfm. Operating 12 hours per day and six days per week, this engine will draw in 6,480,000 cubic feet of air, which at a concentration of 2 grains of dust per 1000 cu. ft. will contain 12,960 grains of dust, or 1.85 pounds. And this is in the so-called clean localities.

The author describes the construction and operation (with advantages and disadvantages) of dry type filters, oil coated viscous impingement type filters, automatic self-cleaning filters, oil bath air cleaners, and the Cycoil gas cleaner. Dust or other abrasive matter entering the air intake or crankcase breather opening will mix with the lubricating oil and act much as a grinding compound. Dust, says Mr. Sowerby, is the principal cause of rapid wear, resulting in the frequent replacing of cylinder liners and rings and other reciprocating parts.

Paul Williams and J. M. Ravenna, of Skinner Purifiers, Inc., discussed positive control of lubricating conditions in diesel engines. This control, they say, consists of constantly, or very frequently, removing from the lubricant all of the injurious impurities. This is not to be confused with salvaging lubricating oil after it has been used beyond its useful period and has caused dirty engines.

The overhead oil, the authors say, will contain carbonaceous materials, both from the lubricant and from the fuel, certainly entrained moisture, if not both free and entrained moisture, and if the fuel is of a character that it has excessive gums these will work into the lubricant. There will also be fine metal particles and there may be traces of dust. Suitable equipment for the removal of these harmful impurities in the lubricating oil must fulfill the following conditions. It must not affect the oil circulation in the engine; it must remove the impurities that if not removed will combine to be injurious to lubrication; it



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must have ability to control lubrication conditions under any load conditions of the engine; it must have a low cost operation; it must be automatic in operation; it must not require technical control.

S. M. Weckstein, of Timken Roller Bearing Co., discussed maintenance and lubrication of bearings in oil field equipment. In prime movers, the author says, the principal point of bearing application is the crank shaft. The bearings must be selected with a view towards ease of assembly, lubrication and maintenance. Geared pumps and pumping units, he says, may be discussed together since they both have similar characteristics. It is important that the gears be held in proper mesh and that the bearings carry any combination of loads resulting from the operation of the units. In the application of bearings to geared and belt driven powers, consideration has been given to the possible bearing overload due to unbalanced loading. Equal consideration has been given to the possibility of isolated location of units. For this reason extreme care has been exercised in the simplicity of the bearing mounting and the positive provisions made for lubrication. Three types of bearing mountings are commonly used on oil field sheaves. These bearings are of the "NA slotted" type, and all bearings are clamped together on the pin. The closures ride on the ribs of the cones. All bearings are grease lubricated. The grease is introduced through properly drilled holes in the pin. The cones or inner races fit loosely on the pin so assembly can be very easily made.

"When operating conditions and subsequent loads are definitely known," Mr. Weckstein says, "bearings can be selected and installed on the basis of a definite life expectancy. To obtain this expected life the bearings must be properly mounted, well enclosed and lubricated at regular intervals. Once a year it is advisable to flush out the bearings with kerosene or light machine oil to wash out any sediment which may have collected. Likewise, if the equipment is to be shut down for any length of time, it is advisable to remove the lubricant from the bearings and replace it with fresh grease or oil. This will eliminate the possibility of moisture or foreign matter, which might have been in the old lubricant, settling out and causing pitting or corrosion."

D. H. Larsen, of Baroid Sales Department, discussed the new Baroid portable high-temperature high pressure drilling mud filtration tester. The mud layer filtered on the face of the formation must have relatively great impermeability to prevent losing fluid to the formation, and this layer must be comparatively thin in order to offer minimum obstruction to materials which must move in the hole. The author cites examples involving wells of considerable depth, as well as ordinary wells, and points out that it is at great depths and under abnormal pressure conditions that drilling presents those problems of caving, stuck drill pipe, and so on which are solvable only by proper mud control; so the need for testing methods applicable to pressures of the order of 1000 or 2000 pounds per sq. in. and temperature of 150°-250° F. becomes manifest. The author describes the construction and operation of Paroid's new tester.

P. E. Fitzgerald, of Dowell Incorporated, discussed new applications of chemistry to oil and gas wells. "Sustained-Action" acid that does not react right at the bore hole but has a slower action that permits desirable penetration back into the formation has increased permeability farther away from the well bore resulting in less resistance to flow and better utilization of reservoir energy. The effect is not flashy, but permanent. One of the most important improvements ever made to acidizing, the author says, has been the use of organic jellifying temporary plugs to give better control of the acid in the well. The organic gels used until the past few months were introduced as a liquid, set up to a firm gel consistency on the way to the bottom of the well, remained set up during the acid treatment and then liquefied after treatment due to bacterial action. These gels were capable of resisting pressures of over 1000 pounds per square inch in formation with small pores but in larger pore zones, such as in certain very porous sands, the gel had insufficient strength to hold necessary pressure differentials of 500 to 1000 pounds. This has been overcome by the addition to the organic gel of a flaky, organic, chemically inert material working on the "shingle" principle.

Paraffin deposits on tubing and on the face of the pay formation, the author says, are, in general, mixtures of paraffin, asphalt, oil, water, resins, sand, scale and other impurities. Chemical "solvents" are effective when they actually dissolve the binder material of the deposit, which is often true paraffin or asphalt, thus disintegrating the deposit and allowing the other constituents to be carried away in suspension. To permit proper contact and action by the solvent, it is necessary to use a chemical that is as heavy or much heavier, depending upon the technique used, than the oil produced by the well. An organic heavy liquid known as "Red" solvent (inflammable) has a specific gravity of 1.28 and possesses remarkable solvent properties, particularly on impure asphaltic residues.

H. Logan Lawrence, of E. I. du Pont de Nemours & Co., discussed resilient materials of construction for the petroleum industry. Because of it its valuable physical properties rubber has been used extensively in the industry in spite of some almost prohibitive disadvantages. A new material, Neoprene, has been developed by du Pont which offers the advantages of rubber without its disadvantages. Neoprene exhibits the strength, toughness, elasticity and abrasion resistance of rubber, but has a plus value in its inherent resistance to oxidation, sunlight, heat, chemicals and oils. Further, neoprene compositions are flame resistant.

By substituting neoprene compositions for rubber when service conditions are severe, the author says, the designer of oil field equipment does not have to sacrifice efficiency and ease of operation in order to protect the resilient material from contact with oil and gasoline. The availability of an oil-resistant resilient material makes it possible to design entirely new types of equipment. In one instance, if an improved core barrel were to be successful, a bearing was required that could be lubricated with mud, water or oil. Metal bearings would not do, nor would natural rubber or many other compositions. With neoprene, the designers were able to perfect a bearing that permits free rotation of the outer barrel while the inner barrel and core catcher are allowed to idle freely.

Applications include neoprene lined rotary hose, neoprene stripper pack offs in blow out preventers, neoprene for piston rubber, valve insets and sleeve packing in slush pumps which circulate mud slurry, oil and mixtures of the two, neoprene impregnated valve cups, etc.

E. F. Fellows, of National Aluminate Corp., discussed water treatment in the oil fields. While water treatment in oil fields has probably received less attention during the past decade of rapid developments than has any other phase of operation, there is little excuse for obsolete methods being used and almost all problems can be solved with present day knowledge, the author says.

"Bad Water" costs to oil companies run into a staggering annual total. When the boilers go bad hole can not be made and in tight spots the well may be lost or a long difficult job in getting the pipe loose may result. Any operator in an area new to him should carefully check the water supplies available before moving in rig. If usable water cannot be found chemical means can almost always be provided so that uninterrupted operation can be maintained.

(Continued on page 34)

Internal Combustion Engine Heat Flow

to Cooling Water Analyzed

Read at C. N. G. A. May Meeting

By C. J. Vogt
Assoc. Professor of Mechanical Engineering,
University of California

The primary function of an internal combustion engine is to convert the chemical energy supplied in the fuel-air mixture into useful mechanical energy. The results of engine tests available in the literature indicate that only a minor part of the energy supplied is made available as useful work and that the energy supplied the cooling medium is approximately equal to the indicated horsepower of the engine[1]*. This loss from the working medium occurs during combustion and expansion strokes due to the high pressures and temperatures encountered, and results in a material reduction in engine efficiency. Since this heat must be dissipated by the cooling medium, a knowledge of the means by which it is transferred is important from both the standpoint of engine design and operation.

The problem of heat transfer in engines has been under investigation since 1884 at which time Grashof analyzed the heat flow in the cylinder wall of a steam engine and its effect on condensation. With all the available data presented since these early investigations there still remains much to be desired.

The transfer of heat from the hot gas in the cylinder to the walls takes place by a combination of three methods, radiation, conduction, and convection.

The heat transferred by radiation from combustion of hydrocarbon-air mixtures has been investigated[2], [3], [4]. The results indicate that the energy radiated is a function of time, spectral brightness and absorptivity of the gas mass, as well as the geometry of the mass. The spectral brightness and absorptivity are dependent upon the constituents of the gas mass, and in an engine to a certain degree upon the operating characteristics.

* Numbers refer to bibliography.

The results of tests in bombs[2] in which the surface was blackened to assimilate black body radiation were compared with similar tests with the surface polished. The results indicated that the

C. J. Vogt

energy radiated to the polished surface was only 7 percent of the black body radiation. On the basis of these tests the heat transferred by radiation is found to be proportional to the radiation factor which is expressed by[5]

$$q = \frac{0.127\left[\left(\frac{T_1}{100}\right)^4-\left(\frac{T_2}{100}\right)^4\right]}{\left(\frac{1}{C_1}+\frac{1}{C_2}-1\right)\left(T_1-T_2\right)} \text{ BTU/hr./deg.F./sq. ft.} \quad (1)$$

where T_1 = the temperature of the gas, deg. F. absolute

T_2 = the temperature of the wall, deg. F. absolute

C_1 = the absorption coefficient of the gas mass

C_2 = the absorption coefficient of the wall.

In applying Eq. (1) to heat transfer data on engines, Nusselt found that the average contribution to the heat transferred from the gases to the cylinder walls by radiation was less than 2 percent of the total. On the basis of these investigations, it is reasonable to conclude that radiation accounts for only a small fraction of the total heat flow and, in light of the necessary assumptions, may be neglected. The heat which is conducted through the cylinder walls may therefore be considered as reaching the gas film, or boundary of the gas mass, by convection due to turbulence in the cylinder.

The quantity of heat transferred through the cylinder wall in unit time is given by

$$Q = U\,(T_1-T_3)\,A \text{ BTU/hr.} \quad (2)$$

where U = the overall transfer factor, BTU/hr/deg.F./sq.ft.

A = the area under consideration, sq. ft.

T_1 = average gas temperature over the area, deg.F.

T_3 = average temperature of the cooling medium, deg.F.

The area A through which heat leaves the cylinder is a function of piston position. The overall transfer factor is the sum of the transfer factor for radiation, which will be neglected, and the transfer factor for conduction. The latter is defined by the equation of thermal resistance as

$$\frac{1}{U} = \frac{1}{h_g} + \frac{t}{K_m} + \frac{1}{h_w} \quad (3)$$

where h_g = gas film transfer factor, BTU/hr/deg.F./sq.ft.

t = thickness of cylinder wall, ft.

K_m = thermal conductivity of the cylinder wall material, BTU/ft./deg.F./sq.ft./hr.

h_w = film transfer factor of the cooling medium, BTU/hr./deg. F./sq.ft.

Nusselt found, from his experiments with bombs, that the gas film transfer factor could be expressed by the empirical relation

$$h_g = 0.0277\,(P^2T)^{\frac{1}{3}} \text{ BTU/deg.F./sq.ft./hr.} \quad (4)$$

where P = gas pressure, lbs./sq.in.abs.

T = gas temperature, deg.F.abs.

Equation (4) satisfies the condition under which a gas is cooled at constant volume. Since in an engine the volume varies with time, and since the degree of turbulence in the burning charge varies

with piston velocity, Eq. (4) was written as

$$h_g = 0.0277\left(P^2T\right)^{\frac{1}{3}}\left(1+0.0063w\right) \text{ BTU/deg.F./sq. ft./hr.} \quad (5)$$

where w = mean piston speed, ft./min. = 2 NS

N = revolutions per minute

S = stroke, ft.

The water film transfer factor U_w Eq. (3) may be obtained[5], [6] from

$$\frac{U_w d_v}{k_w} = 14.5\left(\frac{vd_v}{Z}\right)^{0.8} \quad (6)$$

where U_w = transfer factor on water side BTU/deg.F./sq.ft./hr.

d_v = equivalent pipe diameter of the annular cooling space,, inches

$$= \frac{D^2-d^2}{d} \quad (7)$$

D = outer diameter of annular cooling space, inches

d = inner diameter of annular cooling space, inches

k_w = thermal conductivity of water, BTU/ft./hr./ft.^{2}/deg.F.

v = mass velocity, lbs./sec./sq.ft.

Z = viscosity of cooling water relative to the viscosity at 68° F. centipoises.

With the use of Eqs. (5) and (6) the overall resistance to heat flow from the cylinder to the cooling medium can be determined by Eq. (3).

In order to subject an engine to such an analysis it is necessary to obtain an indicator diagram from which the pressure, volume and temperature relations may be determined. This is not always possible, in fact, not always desirable. The passage through which the indicator element communicates with the cylinder has a marked bearing on the results obtained. The results of investigations[7] of the characteristics of three recognized high speed indicators showed that the indciated mean effective pressure obtained from the indicator diagrams might vary as much as 12 percent. It is therefore evident that a restricted passage to the indicator may give a diagram which would not be representative of the pressure volume relation in the cylinder. With a knowledge of the process in the cylinder with possibly the compression and combustion pressures, and the engine dimensions it is possible to calculate an indicator diagram which is satisfactory for most investigations.

The above relations were used in calculating the heat transferred to the cooling water in a 4.25" x 5.50" six cylinder solid injection Diesel engine and the result compared with those determined experimentally. The pressure-time diagram (Fig. 1) was calculated from the following test data. The brake horsepower was obtained from measurements on an electric dynamometer, the friction horsepower by cutting out successive cylinders and measuring the output of the remaining five cylinders and the indicated horsepower from the sum of the brake and friction horsepowers. The compression pressures and maximum pressures were obtained with the use of maximum pressure indicators while motoring and operating under power. From these data and engine dimensions the indicator diagram may be closely approximated, and quite accurately so with the enthalpy-entropy diagrams available in literature[8], [9].

The data used in calculating the indicator diagram in Fig. 1 are:

TABLE I

Number of cylinders	6
Bore and stroke	4.25" x 5.50"
Connecting rod length	11 inches
Compression ratio	13.4:1
Engine speed	1600 RPM
Brake horsepower	96.5
Friction horsepower	30.0
Indicated horsepower	126.5
Compression pressure	431 lbs./sq.in.
Combustion pressure	800 lbs./sq.in.
Initial pressure	13 lbs./sq.in.
Initial temperature	200° F.
Lower heating value of fuel	18,200 BTU/lb.
Fuel injected per cycle per cylinder	1.55 x 10^{-4} lbs.
Air per cycle per cylinder	29.1 x 10^{-4} lbs.

To illustrate the method of calculating the heat transfer from the working medium to the cooling water the conditions existing at a crank angle of 60° on the expansion stroke will be used (Table III) for which the pressure is 200 lbs. per sq. in., volume 29.7 cu. in., and temperature 3350°F.abs. The gas film transfer factor Eq. (5) becomes

$$U_g = 0.0277\left(200^2 \times 3350\right)^{\frac{1}{3}}\left(1 + 0.0063 \times 2 \times 1600 \times \frac{5.5}{12}\right)$$

$$= 145 \text{ BTU/hr./°F./sq.ft.}$$

The thermal resistance of the steel cylinder wall ⅜" thick for which the thermal conductivity K_m is 26.0 BTU/hr./°F./ft./sq.ft. becomes:

$$\frac{t}{K_m} = \frac{3}{8} \times \frac{1}{12} \times \frac{1}{26} = \frac{1}{832}$$

The water film transfer factor from Eq. (6) becomes

$$U_w = 14.5\,\frac{k_w}{d_v}\left(\frac{vd_v}{Z}\right)^{0.8} \quad (6a)$$

The value obtained for this factor must correspond to the test conditions and engine dimensions. The temperature of the cooling water during the test considered was 57°F. to the engine and 151° F. from the engine. From these data the logarithmic mean water temperature

$$T_{wm} = \frac{151-57}{\log_e \frac{151+460}{57+460}} - 460 = 108°\text{F.}$$

for which the constants of the water were determined as

thermal conductivity of water k = 0.36 BTU/hr./sq.ft./°F. at 108°F.

viscosity of water Z = 0.63 centipoises at 108°F.

rate of water circulation from test = 7.0 lbs./min./cylinder

$$\text{mass velocity } V = \frac{\frac{7.0}{60}\,\frac{144}{A}}$$

where A is the cross-sectional area of the annular cooling space reduced to the equivalent pipe diameter and based on an annular thickness of ¼", for which Eq. (7) becomes

$$d_v = \frac{5.5^2-5.0^2}{5.0} = 1.05$$

and

$$A = \frac{\pi \times 1.05^2}{4} = .87 \text{ sq. in.}$$

then

$$v = \frac{7.0}{60} \times \frac{144}{.87} = 19.3 \text{ lbs./sec./sq. ft.}$$

The dimensions of the cooling space have a great influence on the mass velocity as indicated in Table II which is based on a flow of 7.0 pounds per second per cylinder. This indicates that by a slight decrease in the width of the cooling space the mass velocity may be appreciably increased and with it the transfer factor on the water side Eq. (6). The increase in the transfer is due, physically, to the turbulent flow in the cooling jacket and the accompanying scouring

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action at the water boundary. In the engine tested, the dimensions of the cooling space varied from point to point, also high frequency vibrations were evident at all engine speeds. These conditions tend to cause a turbulent state in the cooling medium and therefore, for the calculation, the flow was assumed to be such as might be obtained in an annular cooling space of ¼ inch thickness. With this assumption the water film transfer factor is Eq. (6a).

$$U_w = 14.5 \times \frac{0.36}{1.05}\left(\frac{19.3 \times 1.05}{0.63}\right)^{0.8} = 79.8 \text{ BTU/hr./deg.F./sq. ft.}$$

The thermal resistance Eq. (3) is then

$$U = \frac{1}{145} + \frac{1}{832} + \frac{1}{79.8}$$

$$= 0.0206$$

From which the overall transfer factor at 60° crank angle is

$$U = 48.5 \text{ BTU/hr./°F./sq.ft.}$$

The area A Eq. (2) will be taken as the exposed area of the cylinder wall swept by the piston corresponding to the crank angle under consideration, plus the area of the cylinder head, plus one half the area of the piston exposed to the gases. The area of the cylinder head is taken rather than the area of the combustion chamber because much of the heat transferred to the head is not transferred to the cooling water. One half the area of the bore is taken for the equivalent piston wall area which transfers heat to the cylinder wall, since tests [10], [11] have indicated that the maximum temperature drop occurs between the second and third piston ring. Further, Salzmann[12] has shown that of the heat received by the piston 67 percent is transferred to the wall through the upper ring, 24 percent through the remaining surfaces of contact, and 9 percent to the crank case. On the basis of the measured temperature it is reasonable to assume that the rate of heat transfer to the piston is not as great as to the cylinder walls and therefore assume that the area transmitting the heat from the piston is equal to the area of the two upper rings which in this engine was approximately one half the bore. Hence, area transferring heat to the cylinder wall at 60° crank angle is:

Area swept by the piston	$= \frac{4.25\,\pi \times 1.65}{144}$	= .153 sq. ft.
Cylinder head = area of bore	$= \frac{4.25^2\,\pi}{4 \times 144}$	= .098 sq. ft.
Piston = 1/2 area of bore		= .048 sq. ft.
Total area at 60° crank angle = A		= .299 sq. ft.

With the above calculated transfer factors and areas, the heat transferred to the cooling water at 60° crank angle is Eq. (2).

$$Q = 48.5\ (3350 - [108+460])\ 0.299$$
$$= 40{,}500 \text{ BTU/hr./cylinder.}$$

This value represents the heat transferred to the cooling water if the conditions existing at the crank angle of 60° would obtain throughout the cycle. Since this is not the case, an average gas film, transfer factor U_g is obtained from those determined at successive piston positions (Table III, Fig. 1) and substituted in Eq. (3). The average overall transfer factor so obtained is then substituted in Eq. (2) with the area A equal to the maximum in the cycle, the mean gas temperature in the cylinder and the logarithmic mean water temperature. This will give a close approximation to the value obtained from a mean of successive calculations. The results of such calculations for various conditions of operation compared with the results obtained from engine tests are given in Table IV.

The results are in good agreement considering the necessary assumptions made in the calculations. An appreciation of the variation of the heat flow with time can be obtained from the variation in the gas film transfer factor (Table III). The transfer factor with time between piston ring and cylinder wall showed similar variations[13] and since the maximum heat transferred from the piston was through the upper ring it is evident that the oil film is not as complete in this region as is normally expected. This heat flow could be more evenly distributed among the rings if the theory of lubrication presented by Reynold's was considered, namely that parallel surfaces can carry no load. Gümbel has shown that parallel surfaces with rounded edges can carry load, and tests by Eweis[14] give evidence of appreciable decrease in friction when this principle is applied to piston rings.

TABLE II

Width of Annular Cooling Space, inches	Equivalent Pipe Diameter, inches	Mass Velocity lbs./sec./sq.ft.
¼	1.05	19.3
⅜	1.62	8.16
½	2.05	5.10

TABLE III

The Relation Between Pressure, Temperature and Gas Film Transfer Factor in a Diesel Engine

Crank Angle	Intake and Compression			Expansion and Exhaust		
Degree	P lbs./in.²	T °F.abs.	U_g	P lbs./in.²	T °F.abs.	U_g
0	14.7	2000	21.4	431	1640	190.0
15	13	1680	18.6	800	4450	501
30	13	1200	16.6	590	4260	323
45	13	980	15.5	325	3690	206
60	13	840	14.8	200	3350	145
75	13	760	14.3	137	3080	109.5
90	13	710	14.0	102	2890	88.0
105	13	680	13.7	83	2820	76.1
120	13	660	13.6	70	2710	67.0
135	13	660	13.6	62	2640	61.5
150	13	660	13.6	53	2560	55.5
165	13	660	13.6	33	2480	39.6
180	13	660	13.6	14.7	2420	22.8
195	14	660	14.3	14.7	2380	22.7
210	15	670	15.0	14.7	2330	22.5
225	15	682	15.2	14.7	2280	22.4
240	17	704	16.6	14.7	2250	22.2
255	20	724	18.7	14.7	2210	22.1
270	27	817	21.9	14.7	2170	22.0
285	36	865	29.4	14.7	2140	21.9
300	52	930	38.4	14.7	2110	21.8
315	90	1090	58.5	14.7	2080	21.7
330	165	1270	92.3	14.7	2050	21.6
345	305	1480	146.0	14.7	2030	21.5
360	431	1640	190.0	14.7	2000	21.4

Summary

The results of the investigation indicate that, in spite of the seemingly large number of assumptions necessary for an analysis of the heat flow to the cooling water, calculated values are in good agreement with test results. The designer of engines can decrease the weight of cooling water required by decreasing the water space and thus increase the water film transfer factor. Since the maximum amount of heat transferred from the piston to the cylinder wall is through the upper ring, there is evidence of dis-

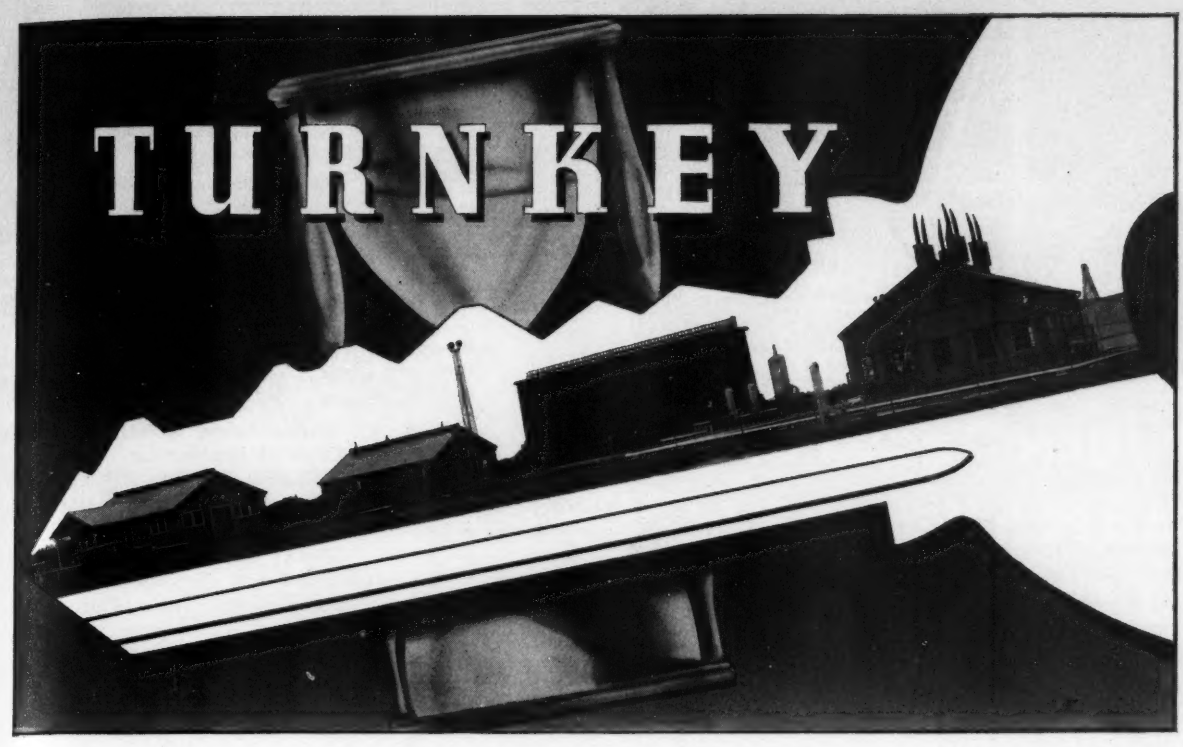

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TABLE IV

Results of Calculation and Test

Full Load Speed RPM	Heat to Cooling Water Calculated BTU/Min.	Heat to Cooling Water Test BTU/Min.	Difference Percent
800	2,400	2,390	0.4
1200	3,140	3,100	1.3
1600	3,900	3,950	1.2
2000	4,670	4,510	2.5
	Constant Speed Run 2000 RPM		
B. HP.	Q, Calc. BTU/min.	Q, Actual BTU/Min.	Difference Percent
20	2,500	2,460	3.6
40	2,730	2,860	5.2
60	3,080	3,270	5.8
80	3,600	3,800	5.2
	Constant Speed Run 1600 RPM		
B. HP.	Q, Calc. BTU/min.	Q, Actual BTU/Min.	Difference Percent
20	2,030	1,820	11.5
40	2,360	2,260	4.4
60	2,810	2,730	2.9
80	3,380	3,280	3.0

continuous fluid film lubrication. The basic theory of lubrication indicates that better distribution of heat flow between piston and cylinder wall and also better cylinder wall lubrication than now obtained is possible.

Acknowledgement

The author is indebted to Mr. A. R. Collins for assistance with the calculations.

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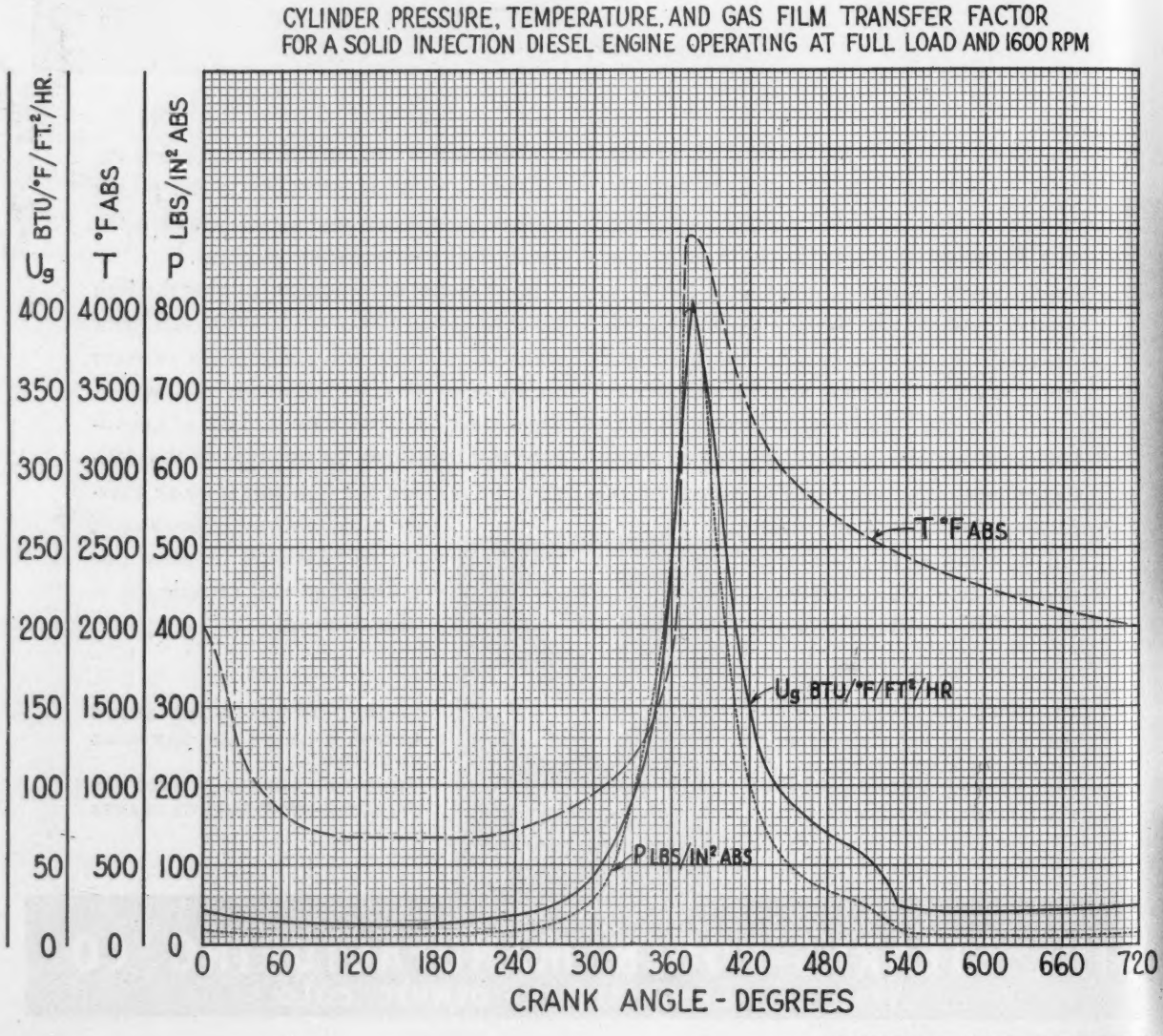
FIGURE 1



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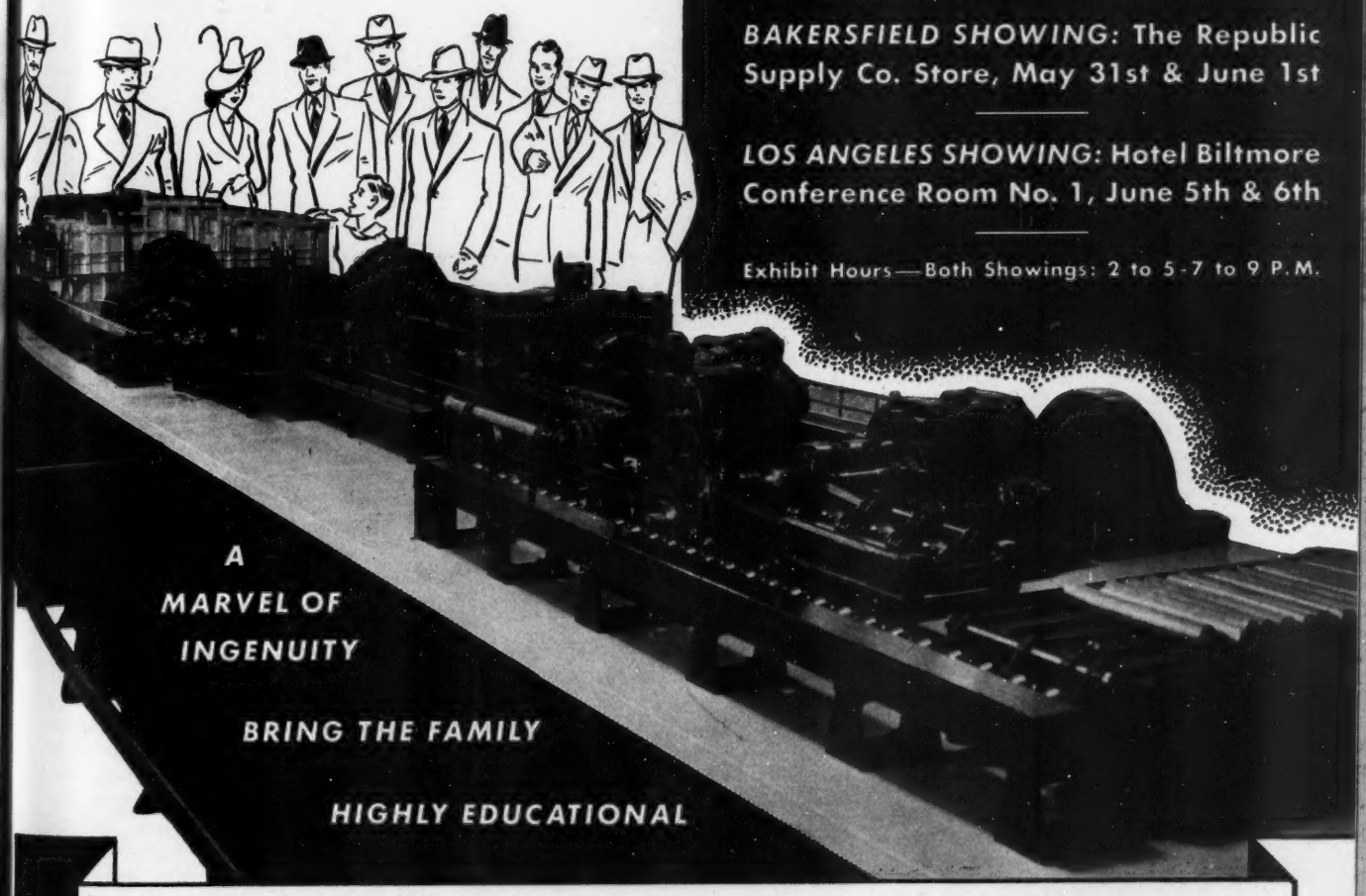

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L. G. Metcalf Appointed Marine Operations Chief

Appointment of Lester G. Metcalf as manager of marine operations, succeeding William Groundwater, resigned, was announced recently by W.L. Stewart, Jr., vice-president, Union Oil Co. of California. Formerly manager of manufacturing, L. G. Metcalf has been associated with Union Oil Co. for the past 25 years. He is a graduate of Pomona College and Massachusetts Institute of Technology.

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A record breaking attendance of oil men from all parts of the country heard of many new developments in drilling, production and refining at the Mid-Year meeting of the American Petroleum Institute, May 15-19, at New Orleans. There were 65 committee meetings, seven group sessions, and a general session.

Eugene Hosford and Emory Kemler, both of Gulf Oil Corp., spoke on well pumping characteristics. Their analysis constituted a part of a paper comprising a long-time exhaustive study of the behaviorism of oil wells and a comprehensive review of conditions at the bottom of oil wells as revealed by the dynamometer.

Dynamometer cards are the signatures of the oil wells themselves and show, to the expert able to analyze them, the conflicting influences and conditions under which producing equipment is operating. Data revealed include the tremendous pressures encountered by pumping equipment, the power required for the most efficient operation, and even the power losses from friction. It was explained that the cards indicated to the experienced engineer not only the conditions encountered, but how difficulties may be avoided as well as remedied.

Measure Various Loads

Individual instruments are available to the engineer for measurement of torque loads, pressures, speeds, friction losses, and other characteristics. The dynamometer, a device of relatively recent application to oil well problems, combines the readings of other instruments into one measurement. Produced graphically on a small card, the oil well's "signature" appears as an oval-shaped pattern whose irregularities provide the key to the well's character and its ailments.

Rating The Well

"Dynamometer data," said the authors, "have application during three phases of a well's history. The first general application is in selection of equipment. The second is to check operating conditions where equipment has been installed, to prevent trouble or improve conditions. And the third is the application of dynamometer data to troublesome wells to reduce or to eliminate the trouble.

"The problem of equipment selection is not, at first as might be expected, that of rating the equipment, but the more difficult problem of rating the well."

Various committees of the Institute's Division of Production and Refining have developed specifications for rating producing and refining equipment. This paper is among the first, if not the first, attempts to develop specifications for rating the performance of an oil well.

The dynamometer cards, it was stated, do not limit their service to indicating the nature of the trouble. They can be used to determine if changing the speed of pumping, the length of the pumping stroke, or the substitution of heavier or lighter equipment would effect any improvement.

"If trouble develops during the operation of the well," the authors stated, "dynamometer studies offer a means of investigation that is much cheaper than trial and error methods. Such studies also offer a cheap and easy means of obtaining advance information on the results of changing to pumping equipment designed to produce a well at its full capacity."

Squeeze Cementing

Another paper dealing with the diagnosis and cure of oil-well ills was that of Paul D. Torrey, of the Sloan and Zook Co., entitled "Selective Exclusion of Fluids from Wells." The paper was sponsored by the Institute's Southwestern District Committee on Production Practice and was devoted to the process known as "squeeze cementing" as a means of completing wells or improving production in those already completed.

Cement forced into the well under high pressure has been found effective in shutting off water intrusion, and in reducing excessive gas-oil ratios. The application of cement and gun-perforating of casing to the testing of deep wildcat wells also formed part of Mr. Torrey's discussion. Other enumerated functions of cementing operations included protection of shallow formations for production after deeper formations have been exhausted; protection against corrosion of the casing; protection against migration of oil or gas from one formation to another, and the ability to set casing to any depth desired without regard to the total depth of the hole.

Petroleum engineers participated in a veritable intellectual field day of field welding of casing. They were interested less in how the welding actually is done than in what actually happens to the casing welded, studying critical hardness, temperature, quenching facilities, cooling rates, and other indices of behaviorism of casing welded in the field.

Engineers explained that through a study of factors involved in the welding of casing under field conditions, they were attempting to develop, among other data, methods of perfecting the operation so that operating economics may be assured. If desirable savings are to be made in the use of casing welded in the field, in lieu of the usual screw casing, they pointed out, proper welding technique, cooling rates, and other data must be known in order that the weld material may have physical properties closely approaching those of the body of the pipe.

A mathematical formula which may be used to determine the temperatures and the time rate of change of temperatures in or near cooling welds was presented by W. A. Bruce, of The Carter Oil Co., as a contribution to accuracy of measurements. Mr. Bruce said the formula showed a deviation from the mean of less than six percent in determining the thermal behavior of cooling casing welds.

Methods of determining critical temperature ranges of steel by the use of the dilatometer were described by L. H. Winkler, of Bethlehem Steel Co., who said the operation indicates the relative extent of dimensional changes and stresses taking place during the cycles of heating and cooling, and points the way to ascertaining which are the weldable steels.

Fundamental metallurgical elements involved in the problem of weldability were discussed by S. L. Hoyt, of A. O. Smith Corp., who explained that welding technique must differ with the casing steels. He explained the influences of such factors as the composition of the steel itself, the hardening characteristics of the heated zone, and the rate of cooling.

L. R. Hodell, of The Carter Oil Co., closed the symposium on welding with a summarizing paper which, engineers said, would become a reference volume for the industry. Mr. Hodell explained that as a result of the work of Messrs. Winkler, Bruce, Hoyt, and himself, it now is possible mathematically to compute data essential to the success of welding techniques. By proper choice of the chemicals in the casing to be welded and of the electrodes used in the operation, Mr. Hodell explained, it is possible successfully to weld a wide range of oil-well casing under field conditions.

During the past eight years the increase in the rate of penetration in rotary drilling of wells has mounted 123.7

percent. Study of the drilling records of more than 500 wells indicates that increased efficiency of personnel and equipment contributed 55.5 per cent. The weight on the bit also was a contributing factor, Institute members were told.

The report on how the petroleum industry has reduced so greatly the time required to drill its wells was presented by J. E. Brantly, of Los Angeles, and Edgar H. Clayton, both affiliated with the Drilling and Exploration Co., Inc. They said that despite many wells being improperly drilled in the past six years, the increase in the rate of penetration by rotary drilling equipment in some fields may amount nearly to 400 per cent. They cited the Kettleman Hills field, California, as showing a 385 per cent increase; Wyoming fields more than 110 per cent; and West Texas and New Mexico about 75 per cent. Correspondingly high percentage gains were reported for Texas Gulf Coast and Louisiana fields.

The speakers indicated that the personnel factor largely influenced drilling time, recent drilling operations having been directed by specialists who established high requirements for their drilling crews.

"Operations have passed from rule-of-thumb methods in drilling wells to practice based on sound engineering and technical considerations," it was said. Better design, material, and methods of using equipment also were credited with contributing to the increased efficiency.

Propose Cement-Test Code

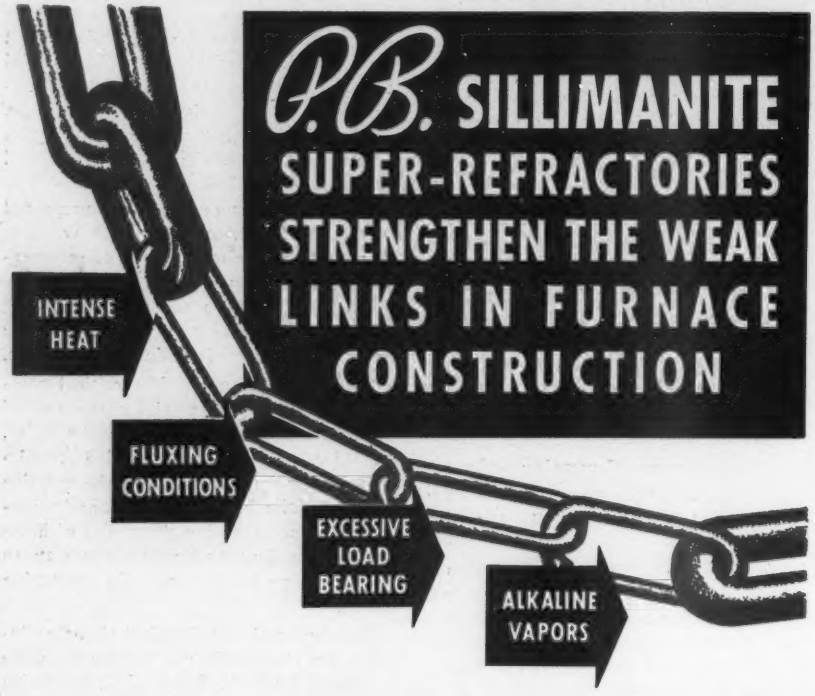
A proposal to establish an American Petroleum Institute code for testing cements used in oil wells was placed before the Division of Production by W. W. Robinson, of The Texas Co., Long Beach, Calif. Mr. Robinson presented a report of an Institute special sub-committee outlining suggested means and methods for standardizing cementing procedure and for testing cements used in oil-well completion. Adoption of standard test measures, Mr. Robinson said, would eliminate much of the confusion now caused by the use of special procedures developed within the industry, and also would be helpful in providing the right types of cements in accordance with specific needs of the various drilling projects.

Recommended procedure included a sieve test to detect lumps, unground, or foreign material; a ring test to determine the amount of water necessary to make a slurry of given fluidity; thickening-time and consistometer tests to indicate how much time can be devoted to mixing and placing the cement before it thickens to the point where it cannot be pumped; tensile-strength test to permit ascertaining the strength of set cement; foam test to eliminate trouble occasioned by large amounts of stabilized foam; and a thorough study of the physical properties of cement.

Suggest Casing Programs

A method of determining in advance just what types, sizes, weights, and grades of casing would be required economically, efficiently, and safely to line an oil well was presented by J. O. Hills, of General Petroleum Corp., Los Angeles. Mr. Hills displayed charts by which engineers can select from available stock casing which is adapted to specific needs and will function safely and satisfactorily to shut off water horizons and give protection at depths predetermined by geological considerations.

In the past, it was explained, casing has been selected chiefly on the basis of "setting depths" which took into consideration conditions obtained only in average fields, with the result that serious errors have been made and avoidable difficulties encountered. Mr. Hills said his method of designing casing programs recognized actual loading conditions and permitted purchase of casing on a proper engineering basis.



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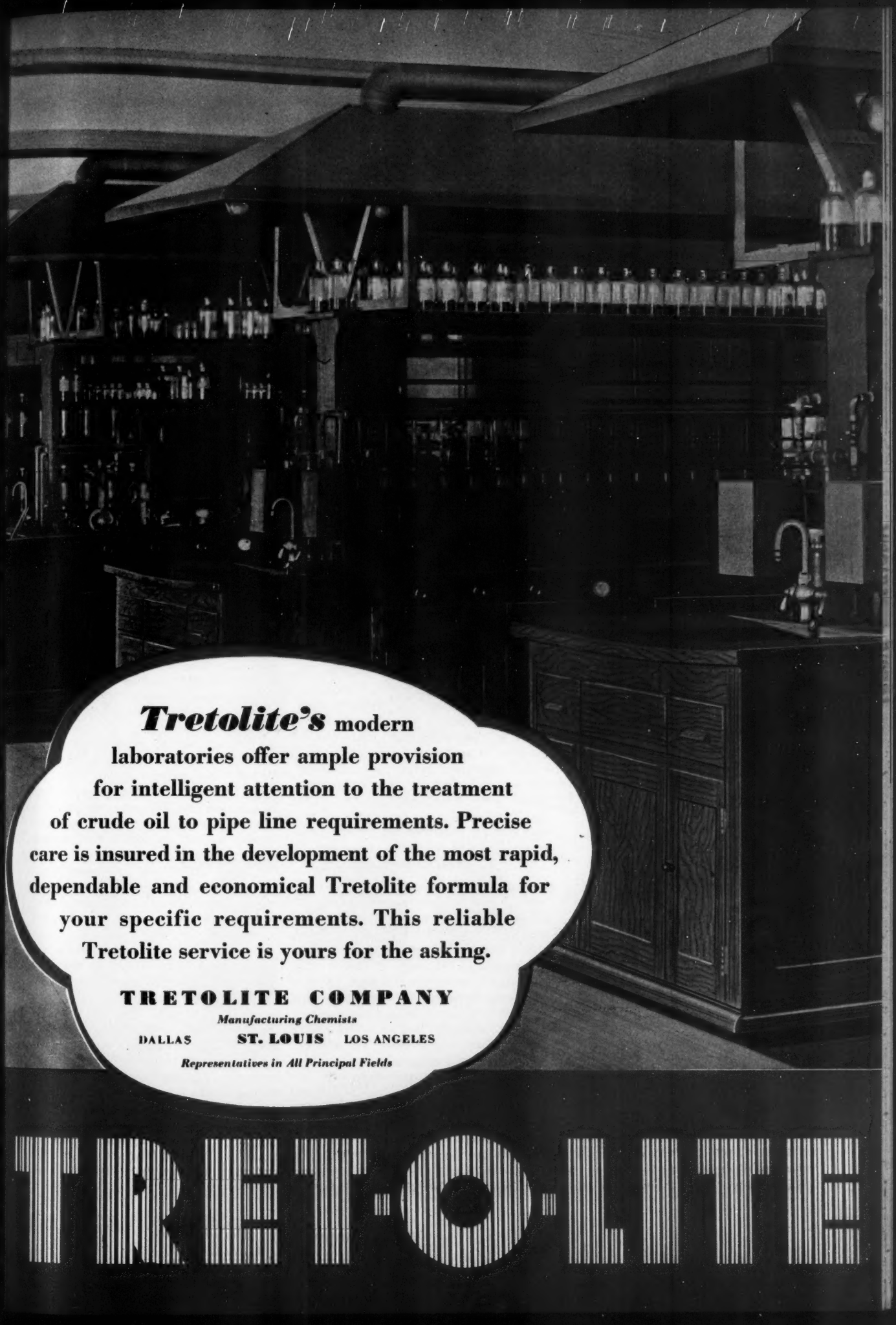
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Selection of a casing program which simultaneously will give ample protection to the well and permit of minimum investment was viewed as being of vital importance under present conditions of increased operating expenses and reduced product prices. Lack of definite pipe-strength data and of knowledge of actual conditions in the well have troubled petroleum engineers for many years, and belief was expressed that advance design of casing programs, as suggested by Mr. Hills, would lead to a decided improvement in this situation. Cost and proper functioning of oil well casing have become more acute problems as wells have been drilled to greater depths. Mr. Hills' charts indicated how, by ascertaining total depth, depth of water horizons, mud weights, and other data, it is possible to plot a casing program which will reveal just what casing should be used for any given well.

Midget Refining Plants

Increased yield and quality of gasoline produced make economically advisable the use of midget polymerization and iso-octane units in connection with small refineries according to W. B. Shanley and Gustav Egloff, of Universal Oil Products Co. They pointed out that the cost of the units is small, $15,000 to $35,000, and said that some of the midget units have paid installation costs in less than 40 days.

It was explained that the use of the midget equipment in connection with small refineries has increased gasoline production from approximately two to eight percent, with an octane rise of one to two numbers when processing naptha, kerosine, gas oil, or topped crudes. Midget iso-octane units, they added, represent an appreciable potential supply of iso-octane and safety aviation fuel in the United States.

The solutizer process for the extraction of mercaptans was discussed by D. L. Yabroff, of Shell Development Co., Emeryville, Calif., and L. E. Border, of Shell Oil Co., Inc. An accurate kinematic viscosimeter for refinery control laboratories was described by E. H. Zeitfuchs, of Standard Oil Co. of California.

The metal spray method of corrosion-protection is neither new in theory nor in practice, D. R. Johnson and E. K. Dewey, Jr., of Continental Oil Co., told a group session of the Institute's Division of Refining. Explaining that the spray method was not entirely successful in early attempts, the speakers said that revision and improvements in means of application had justified a revival of interest in the process.

The metallizing atomizer operates on the same principle as the perfume atomizer. The protective metal is fed into the spray gun in the form of aluminum, steel, or brass wire. The tremendous force of the air rushing through the tip of the atomizer breaks the wire into microscopically minute particles which cling to the interior surface. These form a coating which repels the attacks of acid and sulfur corrosion.

Successful applications made over a period of five years were described, the refinery equipment involved being bubble towers, evaporators, and dephlegmator towers. Exterior applications of atomized metal have been made successfully to pump rods and plungers, resulting in longer life of the equipment and lower replacement costs.

Exterior Application Possible

Exterior application of protective coatings to pump rods and plungers enables continued use of the rods long after corrosion of the original surface would force discarding. Purchase of new pump rods would cost about $300; metalizing represented an expenditure of only about $90 a rod, the authors stated. In the case of the refinery vessels representing an investment of thousands of dollars, which corrosion would render obsolete within a few years, metalizing at a cost of about 75 cents a square foot has saved the equipment for an indefinite period of operation.

Other successful methods of corrosion protection were reported by J. T. Shaler, of the Standard Oil Co. of California. He described the use of chromium sheet linings which are installed primarily as a corrosion resistant, but also possess a desirable heat-insulating characteristic desirable in refinery operation.

The protective linings are alloys of chromium, carbon, nickel, manganese, silicon, phosphorous, and sulfur. The sheets are welded to the interior of the vessels to be protected and the cost will vary between $5 and $10 a square foot.

Non-Metallic Protection

A non-metallic method of corrosion protection was recommended by E. S. Dixon, of The Texas Co., who described the use of gunite liners in pressure vessels. A layer of cement is applied to the interior of the vessel by means of a gun spray, another application of the atomizing technique. The cement application is considered only as a temporary measure, probably limited in its effectiveness about to one year. The cost of the gunite application ranges from 86c to $1.11 a square foot on the basis of one year's service.

T. McLean Jasper, of the A. O. Smith Corp., discussed "Multilayer Construction of Thick-Wall Pressure Vessels." He described the advantages of building walls of vessels from a number of layers of thin steel rather than one layer of solid steel, including ability to withstand greater pressures and a tendency merely to become distorted rather than to shatter and explode when safe pressures were exceeded. The ease and economy of protecting against corrosion by having the inner layer of the metal of a corrosion resistant metal was another advantage Mr. Jasper reported for the multi-layer construction.

Lighting Problems Discussed

Safety, efficiency, and economy factors involved in the lighting of refineries for night operation were discussed by L. E. Priester, of The Texas Co. Explosion-proof lighting systems were recommended for installation in hazardous areas around the refinery.

Selection, location, and application of automatic refinery control devices were considered by H. F. Moore, of the Standard Oil Development Co. He suggested that the next major step in control technology probably is in the field of proper application of present control devices, rather than development of new instruments.

Flying Refineries Proposed As Solution To Safety Fuel Problem

In a paper entitled "Aviation Fuels—Present and Future Developments," presented by S. D. Heron and Harold A. Beatty, of the Ethyl Gasoline Corp., discussed flying refineries, installed on each airplane. Electrically heated, the refining unit would produce cracked gases from kerosine or engine lubricating oil, the gases to be used only in take-offs, the most critical period in aircraft operation.

"A great deal of attention has been given to the fuel safety requirements of aircraft," the authors stated, "and engines are now operating on such fuels as kerosine, fuel oil, and other products of equal flash point. They are not satisfactory, however, in spite of their greater safety, because of their potential failure under take-off load conditions."

The authors then advanced the flying refinery suggestion as the means of producing the higher power fuel for take-off conditions.

The high performance of modern aircraft is, to a large extent, the result of fuel development in recent years, refinery engineers were told by Mr. Heron and Mr. Beatty. At least 50 percent of the improvement in engine power output which has occurred in the last decade is due to octane number increases, the authors of the paper declared. The development has not been limited to allowing a greater throttle increase on existing engines but has led to the introduction of new engines designed to take advantage of the high octane fuels made available by the refiners. A complete re-design of aircraft has accompanied

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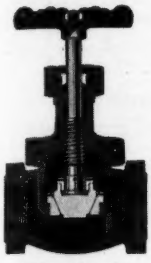

Fig. 1857-P
150 lb. S.P. Plug Type
All-Iron "Ferrenewo"

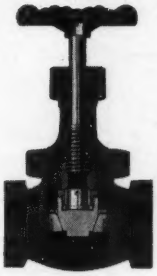

Fig. 16-P
300 lb. S.P. Plug Type
Bronze "Renewo"

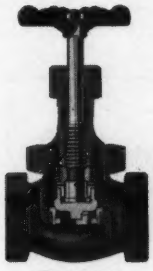

Fig. 1878
350 lb. S.P.
Bronze Globe

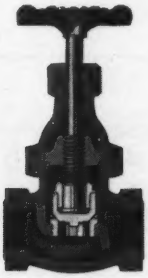

Fig. 1720
600 lb. S.P.
Steel Globe

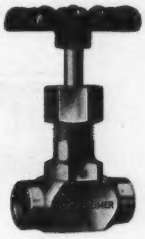

Fig. 1730
3000 lb. W.O.G.
Steel Needle Valve

Fig. 2125
125 lb. S.P.
Double Wedge Disc
Bronze Gate

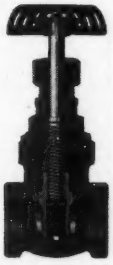

Fig. 2129
125 lb. S.P.
Single Wedge Disc
Bronze Gate

Fig. 1640
150 lb. S.P.
Iron Body
"King-clip" Gate

Fig. 768
200 lb. S.P.
Single Wedge Disc
Bronze Gate

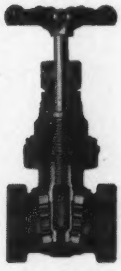

Fig. 1881
350 lb. S.P.
Single Wedge Disc
Bronze Gate

Fig. 1938-D2
300 lb. S.P.
Steel Gate

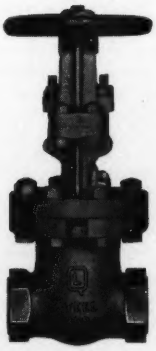

Fig. 1869-B6
350 lb. S.P.
Steel Gate

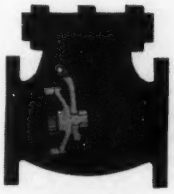

Fig. 1790
125 lb. S.P.
Iron Body Swing Check

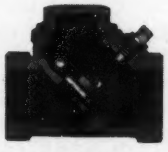

Fig. 1880
350 lb. S.P.
Bronze Regrinding
Swing Check

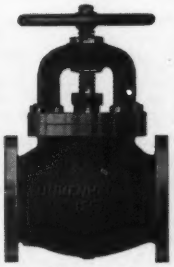

Fig. 1123
125 lb. S.P.
Iron Body Globe

Fig. 1430
125 lb. S.P.
Iron Body Gate

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the engine development, they said "The standardization of 87 octane gasoline in this country," the authors said, "started a trend in high-performance aircraft in which the rest of the world has followed us. There is no reason to believe that still further increase in aircraft performance from improved petroleum products cannot be expected."

Diesel engines have not advanced rapidly in the aircraft field, the authors stated, because of size and weight limitations and because of their frequently unfavorable performance under take-off conditions. The diesel engine is not now available in the ranges of 1,200 to 1,500 horsepower required by the modern aircraft. Engines of 2,000 horsepower are already in demand, while the aircraft Diesel engine of 1,000 horsepower has not been produced, the authors reported.

Need for knock-testing apparatus more sensitive than any of those now available was indicated by the authors, particularly in view of the present tendency to use fuels in excess of 100 octane. The super-octane fuels are produced by the addition of tetraethyl lead to iso-octane.

The need for further standardization and simplification of grading of aircraft fuels was emphasized. In times of emergency, the authors said, the reduction of petroleum products to the minimum possible number of grades will be of outstanding importance.

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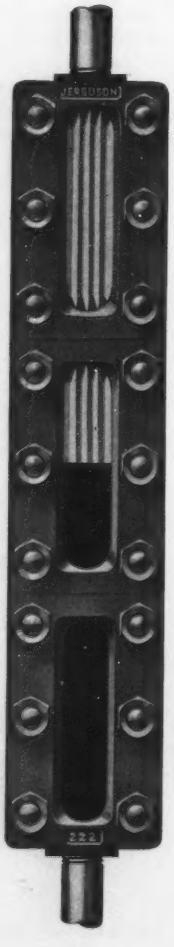

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Federal Oil Leases Urged

Enactment of legislation to permit leasing of lands under the jurisdiction of the War and Navy departments for development of oil and gas was recommended to Congress on May 8 by Secretary of the Interior Ickes. Mr. Ickes' letter, sent to Speaker Bankhead, states that oil deposits are believed to exist at Cerritos Channel, Wilmington Harbor, California; Ellington Field military reservation, Texas; and Barksdale Field, near Shreveport, Louisiana.

World Automotive Engineering Congress

Design and operating problems of aircraft, automobiles, trucks, buses, and tractors, and reports on developments in the fields of fuels and lubricants are on the program of the 1939 World Automotive Engineering Congress being held in four American cities between May 22 and June 8.

Aircraft engines and their fuels will be treated in 18 of the technical papers to be presented in the congress. Ten of those will be delivered by European authorities who are making a special trip to appear at the congress.

The congress opened in New York for a five-day session on May 22; moves to Indianapolis, Ind., May 29 and May 30; Detroit, Mich., May 31 and June 2, and closes in **San Francisco, Calif.**, with a three-day session ending June 8.

The congress is sponsored by the Society of Automotive Engineers.

San Joaquin Oil Men Hold Annual Barbecue

The San Joaquin Oil Men are giving their fifth annual barbecue and golf tournament at Stockdale Country Club, Bakersfield, on June 3.

For the past four years these affairs have been the biggest shows of their kind in California.

Lane-Wells Dividend

Board of directors of Lane-Wells Co. has declared a dividend of 25c a share on their capital stock, payable June 15 to stock of record May 29.

Three large automobile manufacturers are building diesel-engined trucks.

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(Figures of Production and Stocks are in barrels of 42 Gals.)

	Total Production March	—DAILY AVERAGE— Mar., 1939	Feb., 1939	Mar., 1938
Group No. 1				
Arvin	5,061	163	97	.....
Belridge—North	370,953	11,966	12,257	15,143
Belridge—South	37,423	1,207	1,171	1,466
Canal	138,459	4,466	4,081	1,253
Canfield Ranch	1,428	46	24	160
Coalinga	328,444	10,595	9,767	11,424
Cole's Levee	6,983	225	180	.....
Edison	70,072	2,260	2,439	3,903
Elk Hills	313,810	10,123	10,175	11,120
Fruitvale	218,640	7,053	7,305	8,970
Greeley	55,537	1,791	2,090	3,294
Kern River	348,846	11,253	10,938	14,170
Kettleman Middle Dome	1,142	37	40	71
Kettleman North Dome	1,739,082	56,100	57,830	82,264
Lost Hills	106,009	3,420	3,323	3,876
McKittrick	120,856	3,899	3,762	3,766
Midway-Sunset	1,718,505	55,435	55,978	70,728
Mountain View	266,847	8,608	9,243	12,608
Mount Poso	411,456	13,273	13,775	19,789
Rio Bravo	252,491	8,145	7,720	1,002
Round Mountain	360,030	11,614	12,485	17,094
Ten Section	282,373	19,09	8,955	5,237
Tupman	8,186	264	275	.....
Wasco	27,982	903	696	.....
Wheeler Ridge	11,517	372	399	309
Group No. 2				
Capitan	82,649	2,666	2,721	3,116
Elwood	143,647	4,634	4,718	7,178
Rincon	90,626	2,923	3,667	3,770
San Miguelito	72,058	2,324	2,285	3,008
Santa Barbara	8,946	289	381	504
Santa Maria	533,279	17,202	14,909	17,330
Summerland	669	22	34	32
Ventura Avenue	1,044,235	33,685	34,273	36,941
Ventura-Newhall	180,683	5,829	5,575	4,357
Watsonville	930	30	30	50
Group No. 3				
Brea-Olinda	174,729	5,636	5,612	6,082
Coyote—East	78,346	2,527	2,580	3,797
Coyote—West	247,070	7,970	7,985	8,418
Dominguez	658,930	21,256	21,259	28,857
El Segundo	106,993	3,451	3,757	15,989
Huntington Beach	889,011	28,678	27,845	34,234
Inglewood	392,048	12,647	12,602	16,146
Lawndale	2,215	72	71	69
Long Beach	1,503,841	48,511	49,714	56,847
Los Angeles-Salt Lake	15,604	503	552	560
Montebello	465,635	15,021	13,792	8,112
Playa Del Rey	164,321	5,310	5,360	6,710
Potrero	27,239	879	1,064	294
Richfield	263,872	8,512	8,155	9,487
Rosecrans	472,547	15,243	15,855	5,958
Santa Fe Springs	877,831	28,317	28,812	38,996
Seal Beach	235,959	7,612	7,638	9,596
Torrance	678,666	21,892	21,259	7,941
Whittier	30,545	985	986	892
Wilmington	2,638,529	85,114	83,519	100,695
Total	19,283,785	622,058	622,105	723,913
February	17,418,952	622,105		
Decrease (*Increase)	1,864,833*	47		

SUMMARY OF CALIFORNIA OILFIELD OPERATIONS FOR MARCH, 1939—STOCKS HELD IN PACIFIC COAST TERRITORY BY CALIFORNIA OIL COMPANIES

	March 31, 1939	Feb. 28, 1939	March Changes	(Reclassified) Dec. 31, 1938
1. Gasoline-Bearing Crude	39,215,749	38,353,224	+ 862,525	36,225,312
2. Non-Gasoline-Bearing Crude	15,808,425	16,351,774	− 543,349	16,282,177
3. Unblended Nat. Gas	2,137,837	2,290,365	− 152,528	2,699,455
4. Gasoline (not including distributing and service stations)	15,805,417	15,040,909	+ 764,508	13,259,369
5. Naphtha Distillates	1,384,449[1]	1,566,651[1]	− 182,202	1,566,349[1]
6. Gas Oil and Diesel Oil	10,382,404	10,632,151	− 249,747	10,539,937
7. Fuel Oil Residuum	70,551,947	70,773,179	− 221,232	70,957,881
8. All Other Stocks	6,306,740[2]	6,109,390[2]	+ 197,350	6,153,809[2]
TOTAL	161,592,968	161,117,643	+ 475,325	157,684,289
[1]Estimated amount of unfinished gasoline contained in item 5	1,184,846	1,333,333		1,350,379
[2]Coke included in item 8	189,832	156,248		92,066

	New Rigs Up	Active Drilling	Producers Completed	Daily Initial Output	Active Producing	Abandoned Wells Drillers	Abandoned Wells Producers
Group No. 1							
Arvin	3	1	....	....	1	....	....
Belridge—North	2	4	2	610	63	....	....
Belridge—South	1	1	....	....	88	....	....
Canal	1	2	....	....	19	....	....
Canfield Ranch	..	....	....	....	1	....	....
Coalinga	1	13	2	6,884	773	8	1
Cole's Levee	1	3	1	602	2	....	....
Edison	..	....	....	....	88	....	....
Elk Hills	..	....	....	....	169	....	....
Fruitvale	3	3	....	....	173	....	1
Greeley	1	5	....	....	14	....	....
Kern River	3	7	1	10	1,293	....	1
Kettleman Middle Dome	..	....	....	....	3	....	....
Kettleman North Dome	3	11	1	1,791	211	....	....
Lost Hills	..	1	....	....	245	1	....
McKittrick	1	3	....	....	198	....	....
Midway-Sunset	2	4	2	162	2,516	....	6
Mountain View	..	....	....	....	179	....	1
Mount Poso	2	1	1	496	277	1	....
Rio Bravo	1	3	....	....	27	....	....
Round Mountain	..	3	....	....	203	....	....
Ten Section	1	1	1	2,863	29	....	....
Tupman	..	1	....	....	1	....	....
Wasco	..	2	1	3,587	4	....	....
Wheeler Ridge	..	....	....	....	33	....	....
Group No. 2							
Capitan	..	1	....	....	48	....	....
Elwood	..	....	....	....	81	....	....
Rincon	..	....	1	486	52	....	....
San Miguelito	..	2	1	2,684	20	....	....
Santa Barbara	..	....	....	....	26	....	5
Santa Maria	..	2	4	3,465	307	....	1
Summerland	..	1	....	....	18	....	....
Ventura Avenue	2	10	....	....	269	....	....
Ventura-Newhall	2	8	1	1,200	551	1	1
Watsonville	..	....	....	....	7	....	....
Group No. 3							
Brea-Olinda	..	....	....	....	351	....	....
Coyote—East	..	....	....	....	86	....	....
Coyote—West	..	1	....	....	51	....	....
Domingues	1	2	1	737	179	....	....
El Segundo	..	....	....	....	51	....	....
Huntington Beach	1	4	2	643	544	....	2
Inglewood	..	....	....	....	210	....	....
Lawndale	..	....	....	....	6	....	....
Long Beach	..	....	....	....	1,254	....	....
Los Angeles-Salt Lake	..	....	....	....	112	....	....
Montebello	5	15	2	1,400	232	....	....
Playa Del Rey	..	....	....	....	185	....	....
Potrero	..	1	....	....	14	....	....
Richfield	1	1	....	....	295	....	1
Rosecrans	2	4	3	1,232	124	....	....
Santa Fe Springs	..	....	....	....	576	....	4
Seal Beach	1	1	....	....	104	....	1
Torrance	17	21	12	4,895	702	....	1
Whittier	..	....	....	....	150	....	....
Wilmington	7	9	17	19,287	617	....	....
Miscellaneous Drilling	8	24	....	....	....	10	....
Group No. 4—Gas Fields							
Buena Vista Lake	..	....	....	....	4	....	....
Buttonwillow	..	....	....	....	25	....	....
Chowchilla	..	....	....	....	....	....	....
Delano	..	....	2	Gas	....	....	....
Dudley Ridge	..	....	....	....	....	....	....
Goleta	..	....	....	....	....	....	....
McDonald Island	..	....	....	....	6	....	....
Rio Vista	..	....	....	....	22	....	....
Semi-Tropic	..	....	....	....	15	....	....
Tracy	..	....	....	....	5	....	....
March	73	176	58	53,034	13,909	19	28
February	86	178	61	40,742	13,876	8	14
Increase (*Decrease)	13*	2*	3*	12,292	33	11	14

THE NEW DIRECTORY CONTAINS

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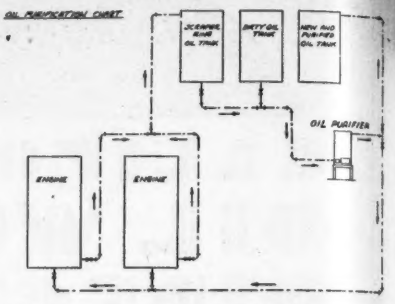
(Continued from Page 16)

"Given an analysis of a particular water the first point to be determined is the use to which it is to be put," the author says. "If for boiler feed the following points must be considered. Will the water form scale? If it will, what type? Sulphate, carbonate or silicate? How much scale will be formed? Will the water be corrosive in the boilers? Will it tend to cause the boilers to foam, or, in oil field language, "Pull Over"? Will it cause a corrosive steam to be generated, which will be hard on power equipment? Is the water of such character as to cause caustic embrittlement of the boiler steel? These points being determined it is usually possible for the trained water engineer to prescribe helpful treatment."

The important role played by the microscope in the petroleum industry was discussed by John T. Rooney. In the petroleum field, this writer says, geologists have used the microscope for identification of strata from their fossil and mineral content, particularly in the examination of core samples. The presence of faults, as indicated by microfracture patterns visible in thin sections of core samples, have been disclosed. Another study reveals optical rotation in certain oils and concludes that this is due to asymmetric carbon atoms, a constitutive property of the molecule. A microtechnique has been described for isolating the possible remains of organisms from which petroleum may have been derived. Microscopic methods have been developed, the author says, for rating the color of oils in cells of standardized depths; for the study of oil emulsions; for the examination of fuel oils; for the control of distillation processes; for the more accurate selection of wax bearing distillate cuts; for the detection of dewaxing difficulties, and for many other applications in this field. An ingenious application of microscopic methods to the examination of crank case oils has been made by Dr. Mary Willard, of Pennsylvania State College, who uses a standard Neubauer blood counting chamber to estimate the carbon particles contained by the oil and for an indication of the wear on the engine by recording the number of iron particles identified by chemical microscopy methods.

G. B. Hafer, of the J. T. Baker Chemical Co., in his discussion of the manufacture and packaging of analytical chemicals, traced the history of chemicals to the point where the labels became reliable and reagents could be classed as "chemically pure." Today, American made analytical chemicals are for the most part superior in quality to any made abroad.

James J. Moran, of Kimble Glass Co., discussed requirements governing accuracy and stability in the manufacture of laboratory glassware. The degree of accuracy attainable in the manufacture



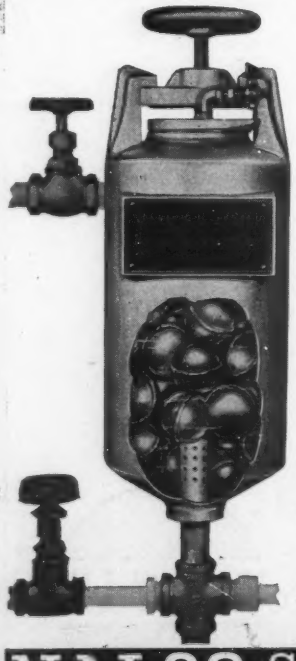
of any piece of graduated laboratory glassware, the author says, depends on the design and workmanship of the item and the method used to calibrate it. The author shows how errors in volumetric measurements may be caused by improper calibration markings, by instability of position, by improper level in reading, by incorrect shading of the meniscus, etc.

The manufacture and testing of that highly important laboratory equipment, the thermometer, was discussed by R. M. Wilhelm, of the C. J. Tagliabue Manufacturing Co. The oil industry uses several hundred thousand thermometers annually. Glass and mercury are the principal raw material, but for low temperatures alcohol, toluol or pentane may be used as the temperature responsive fluid. This author reveals why grade A thermometers possess the characteristics of readability, accuracy, adherence to specifications, and permanence of indications.

Robert M. Blaine and W. Tucker Blaine, of Lloyd's of London, contributed a highly instructive discussion on marine insurance of particular interest to those engaged in the care or distribution of oil well machinery and supplies, shipments of oil in bulk or barrels, and "the innumerable list of valuable equipment moved by land and sea." Marine insurance was a general practice when fire, casualty and life insurance were unknown. The first actual policy was drawn in Genoa, Italy in 1347, and the first mention of insurance in English law was in a statute of 1601 which reads: "By means of a policy insurance, it commeth to pass that upon the loss or perishing of any ship, there followeth not the undoing of any man, but the loss lighteth rather easily upon the many than upon the few."

Geologists predicted oil would be found in the vast Caddo fields in Louisiana four years before the field was brought in.

Cuts Drilling Costs 30%



AT a cost of less than a dollar per boiler per day for chemicals and service, a prominent California oil company recently ran a 1752 hour drilling test using Nalco Feedwater Treatment for the drilling rig boilers. The total saving amounted to $7,666 which was equivalent to a 30% reduction in drilling costs.

Nalco treatment eliminates trouble with scale, corrosion, and carry-over. It permits continuous and uninterrupted boiler operation at higher pressures and ratings. Expenses for fuel, water, repairs, and lost time are reduced.

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NALCO SYSTEM OF FEED-WATER TREATMENT

LAUGH THIS OFF

Life on this harrassed old planet would be a whole lot more enjoyable if people would consider more carefully the far-reaching consequences of their acts. When a Los Angeles excavation job was halted last week, for instance, it not only affected twelve workmen, but 500 people on the sidewalk were also left with nothing to do.

And **Red Grace** appropriately suggests that fewer people would be late for work in the morning if the industry would adopt a simple rule to make the last man in blow the seven o'clock whistle.

Earl Cooper next discloses the fact that the new cars next fall will show some very radical changes. One model will carry the cigar lighter an inch nearer the steering wheel.

While some of the bigger ones will carry Austin swatters.

Did we ever tell you, by the way, about Earl's experience in the collection of ancient art objects? His first purchase was an early Ming vase, and after he got the thing home he couldn't find a single ming to put in it.

Which recalls the pumper whose collegiate daughter answered the doorbell, and yelled, "Father! There's a mendicant at the door." "Well," says the petulous pop, "Tell him we got no mendin' to give him."

"When do you eat dinner?" our guest asked Junior, and the careless kid replied, "As soon as you've gone."

It is our observation that the American boy should be placed in an empty piano case at the age of three, and fed through a knothole until he is 29, thereby saving his parents a great deal of embarrassment.

An **Jim Craig** is our authority for the statement that a bridge party is the only gathering that can properly be called a shin dig.

According to **Clyde Mann,** people are usually refused credit for one of two reasons. Either because they are unknown, or because they are known.

Johnny Quayle on this subject tells us of the lad who owed $100, and when his creditor knocked off $50, he was so grateful that he knocked off the other $50 himself.

There is nothing quite so uncomfortable, however, as being too tired to stay at the office, and too scared to go home.

And did it ever occur to you that they don't need elevators in a Masonic Building? The boys always go up by degrees.

Some of the lads around the pump station were discussing boxing, and the fellow in the far corner remarked that the boys with the cauliflower receivers were much better educated than they used to be. "Educated nothing!" piped **Harry Lee,** who ought to know, "Most of them never dot an i excepting in a fight."

We daren't name it here, but the boys who patronize a certain small town hostelry have christened it the Hotel Fullback—because it get so many kicks.

When the clerk asked a Los Angeles guest how he slept the night before, the latter replied somewhat sadly, "Gee, I laid awake all night with insomnia." "That's impossible," said the clerk, "Why we just had the place fumigated."

Bill Ferrand, incidentally, reports the case of a Fillmore oil man who takes Scotch highballs for his insomnia. They don't help him to sleep, but he seems to be more satisfied to lie awake.

And when the house to house canvasser told the rousty, "You just make a small down payment, and then nothing more for several months," the latter replied, "Say, who's been telling you about me?"

Two Los Angeles delegates to the A.P.I. were in the dining car, when one gazing out of the window remarked, "Wasn't that a swell gorge." "Yeah," says the other, "But I could have done with some more French fries."

Wherewith we again conclude the whole sordid business. Remember, it's not the cough that carries you off, it's the coffin they carry you off in.

And efficiency experts may come, and efficiency experts may go, but mostly the latter so far as we are concerned.

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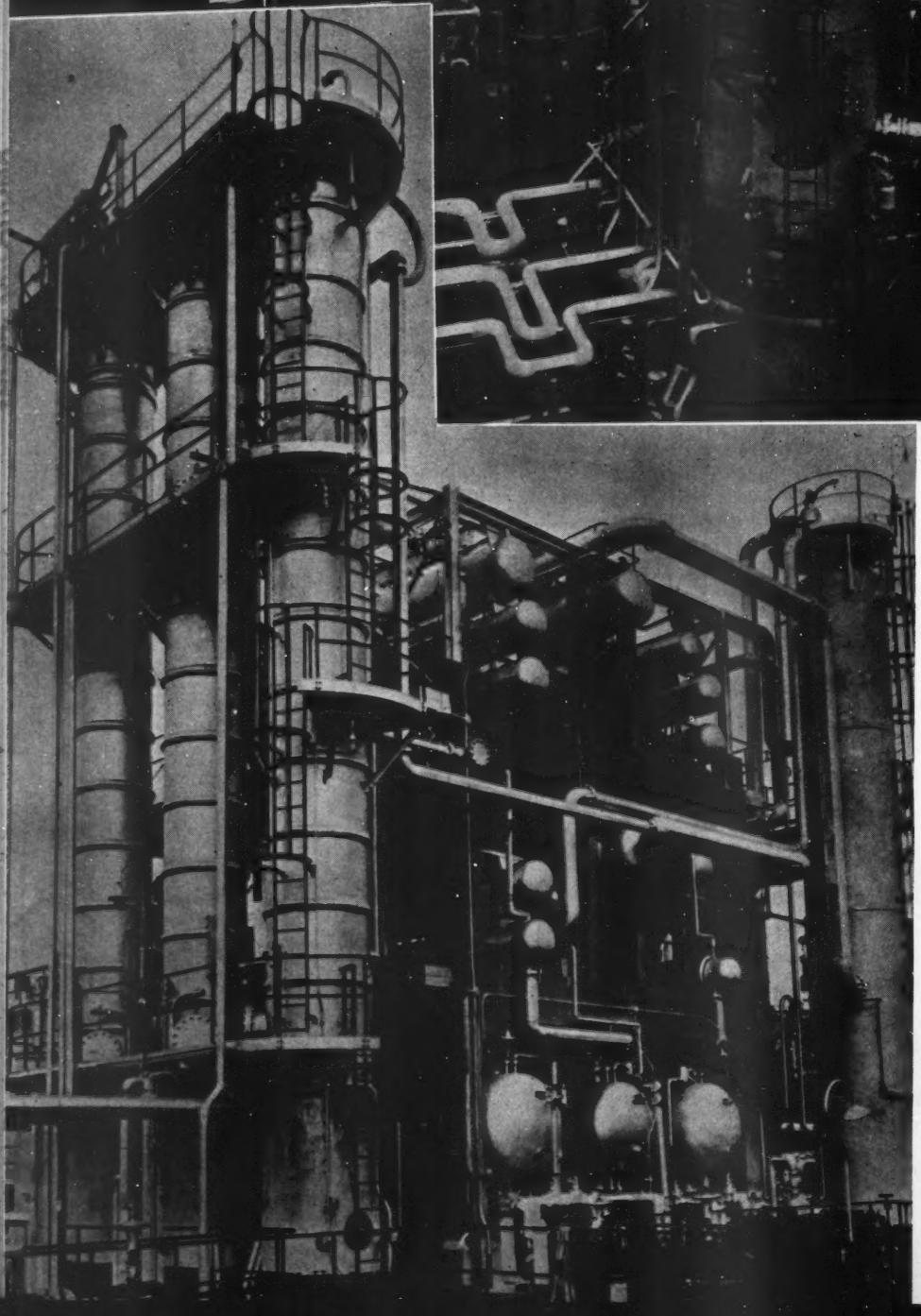

Union's New Solvent Plant

The completion of Union Oil Co.'s new phenol solvent treating unit in the propane solvent plant at Oleum Refinery, last January, marked another significant contribution to the science and economics of modern petroleum refining, and constitutes an important advance in the industrial growth of the West.

This new addition to Union's refining facilities required five months to construct. It is designed to increase the yield of highest quality lubricating oil, and will assure an adequate supply of Triton Motor Oil to meet growing demand for several years to come. Utilizing a single agent—phenol—in place of the benzol sulphurdioxide combination formerly employed in the same phase of the propane solvent process, it produces an appreciably greater yield of pure paraffinic hydrocarbons of highest stability and lubricating quality.

Incorporating many new construction developments, largely designed by Union's own engineering staff, the new unit is another stride in the oil industry's unfaltering march toward better quality and more efficient operation.

Field Development

San Joaquin Valley

Ohio Completes Cole's Levee Well

Ohio Oil Co. KCL No. F-2, bottomed at 9917 ft., and plugged to 9650 ft., was completed flowing 160 bbls. a day through a 3/64 in. bean. This well lies a quarter of a mile north of No. F-1, discovery well, in sec. 10, 31-25. KCL No. F-3 is a rig located near the center of sec. 11 as an offset to the Union Oil Co. Kernco No. 1-11.Union Oil Co. has erected a rig for a well one location north of it's producer, to be known as Kernco No. 2-11.

One half mile south of production Tidewater Associated Oil Co. drills KCL No. 61 below 9700 ft. in cherty shale. One mile west of the Ohio production Standard Oil Co.'s KCL No. 20-1 is fishing drill pipe after making a formation test during which the well flowed 9,000,000 cubic feet of gas with spray of 55 gravity condensation oil from the interval 8940-9050 ft.

The northerly outpost to production, Richfield Oil Corp's Western 2nd.-B-14-3, located one mile north of production in sec. 3, 31-25, is drilling below 7700 ft. in hard shale.

Shell Hits First Oil Sand in Cantua Test

Shell Oil Co.'s Port Costa No. 48-30, drilling on sec. 30, 17-16 in Fresno county, encountered the Vaqueros formations at 7500 ft. A stringer of oil sand was reported at 7560 ft. Drill is now below 8000 ft. in the Kreyenhagen shales.

The Texas Co. Loeschner No. 1 is rigging up at the easterly edge of the township in which the Shell try is being drilled.

The current tests of the area are prompted by the findings of the Western Gulf Oil Co. activities in the district in 1937, when 38 gravity oil was found in non-commercial quantities on sec. 3, 17-15. This oil was found in the Temblor

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
Fresno County					
Cantua Creek	Shell Oil Co., Port Costa	48-30	30, 17-16	8083	Drilling
	The Texas Co., Loeschner	1	12, 17-16		Rig
Coalinga	Amerada Pet. Corp., SPL	7-17	17, 19-16	8237	Producing
		26-17	17, 19-16		Rig
	Roco Oil Co., Lindblom	1	3, 20-14	1910	Testing
	Rylatt, Harry E., Kipling	3	26, 20-14	1520	Drilling
	Stuart Oil Co.	1	12, 21-14	1410	Testing
	Superior Oil Co., P.V.	1	22, 20-15	5698	Drilling
Fresno Area	Seth Turner	1	4, 14-19		Rig
Gatos Creek	Gatos Creek Oil Co.	1	19, 19-13		Rig
Kern County					
Buena Vista	Gen. Pet. Corp., B.V.A.	1	1, 32-24	4354	Drilling
	Western Gulf Oil Co., K.C.L. Panhandle	1	3, 32-26	4139	Drilling
Buttonwillow	Calif. Explor. Co., Salisbury	1	7, 29-24	12982	Drilling
Canal	Shell Oil Co., KCL	B-87	4, 30-25	13957	Suspended
Delano	Atlas Pet. Co., Moore	1	7, 25-25	3286	Abandoned
Devil's Den	Luxton, W. L.	1	27, 25-18	710	Idle
Edison	Harris, S. F., Zenith	1	27, 30-30	405	Idle
	Renner & R.H.L. Oil Co.	1	27, 30-30	2600	Idle
Elk Hills	Richfield Oil Corp.	A-12-33	33, 30-25	4733	Drilling
	Standard Oil Co.	KCL 21-1	19, 30-25	8414	Drilling
Grapevine	Richfield Oil Corp.	KCL 1	28, 11-20	11000	Testing
Lost Hills	Auman, Allen	Lincoln-Theta 1	12, 26-20	1570	Idle
	California Lands, Occidental	2	24, 26-20	5623	Idle
Mt. Poso	Crestmont Oil Co.	1	20, 26-28	1547	Bailing
	Wright & Eyer	1	28, 26-28	1512	Bailing
Poso Creek	Little & Gilstrap, Keating	2	20, 27-27	2458	Abandoned
Richgrove	Dilamar Oil Corp., Quinn	3	15, 25-27	2929	Idle
Round Mountain	Pan May Oil Co.	2	31, 27-29	1500	Abandoning
	Round Mountain Co.	1	24, 28-29		Rig
San Emigdio	Bannow, Louis E., Irvin	1	15, 10-23		Rig
	Continental Oil Co.	KCL F-1	5, 10-21	2080	Drilling
	Shell Oil Co.	Union 76-31	31, 11-22	3615	Drilling
Strand	Continental Oil Co.	KCL D-2	14, 30-36	7575	Drilling
	Tide Water Assoc.	KCL-E-35-7	7, 30-26	8364	Testing
Trico	Standard Oil Co., T. G. & T.	2	2, 25-23	2430	Shut in
	Standard Oil Co., Tulare Farms	2-1	35, 24-23		Location
Wasco	Getty, George F., Janssen	1	7, 27-24		Rigging up
	Union Kernco	1-36	36, 27-24	12985	Stdg. Cem.
Kings County					
Strattford	P. W. Burnham & Assoc. Bartells	1	23, 20-20		Rig
Tulare County					
Ducor	Amal. Oil & Gas Co., Konda	6	23, 24-27	1965	Drilling

zone, and the hole known as S.P.L. No. 3 was abandoned just below 8500 ft.

The contention that commercial production exists near the findings is substantiated by the fact that both companies have blocked up considerable acreage and are backing their beliefs with both money and effort.

Eocene Test Wells Seek Pool Extension Limits

Bandini Petroleum Co.'s well No. 48-18, one half mile west of the Amerada discovery of Eocene oil north of the pool, is drilling well below the 11¾ in. surface pipe set at 628 ft. First extension test to get under way in the Amerada area, the project will be carefully watched by the many leaseholders north of the previously conceived pool limits.

Amerada Petroleum Corp.'s discovery well S.P.L. No. 7-17, located in sec. 17, 19-16, has settled down to a curtailed flow of 345 barrels of clean 31 gravity oil. More than two million feet of gas accompanies the oil production.

Meanwhile Superior Oil Co. has made more than 5500 ft. of hole in P.V. No. 1. Located three miles southwest of Lytle area Eocene production, on sec. 22, 20-15, the well is being drilled on Pleasant Valley Farming Lands in an effort to find a new field between the Eocene pool nose and the old west side Coalinga field.

WHY

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Gatos Creek Test Rigging To Drill

Planning a test of wholly virgin territory, the Gatos Creek Oil Co. is rigging up well No. 1, located on sec. 19, 19-13. The area lies 13 miles west of the old Coalinga field in a district which has never been drilled.

Tide Water Strand Well Wet on Production Test

First production test of Tide Water Associated Oil Co.'s Strand discovery northeast of the Canal field proved a disappointment when a flow of gas and oil was accompanied by much 1250 grain per gallon salt water. A water witch is being run to determine the source of the water.

Located in sec. 7, 30-26, a mile from Canal production, Continental-KCL-E-35-7 cored Stevens oil sand from 8310 to 8355 ft., below which was nine feet of gray sand to bottom at 8364 ft. Results of a formation test before setting casing at 8300 ft. were quite encouraging, clean oil reaching the surface in only 10 minutes and flowing at an unestimated rate for another 10 minutes before the valve was closed.

Arvin Development Continues

With the Standard Oil Co.'s second Jewett well drilling below 4000 ft. in the discovery sec. 16, 31-29, and the Texas Co.'s Jewett No. 1 recovering some 30 gravity oil from a short formation test, this section will apparently soon have a total of four producing wells, three of which are offset to discovery.

At the westerly edge of section 15, as near production as location could be made, Universal Consolidated Oil Co.'s Universal-Derby No. 1 has penetrated a total of approximately 70 ft. of oil sand. The well was last reported as standing cemented with bottom at 6123 ft. after setting 7" pipe at 5944 ft.

Two Buena Vista Trys Drill Ahead

General Petroleum Corp.'s BVA No. 1 in sec. 1,32-24 at the edge of Buena Vista lake is drilling at 4360 ft. after losing a week's time in straightening the hole.

Ten miles to the east, Western Gulf Oil Co. is drilling KCL-Panhandle No. 1 below 4000 ft. This test lies a mile and a half southerly along the axis of the Buena Vista Lake gas field from the most southerly production, in almost untested territory, as the sole operation antedating the try was a 5627 ft. hole in sec. 4 by the Ohio Oil Co.

Buttonwillow Wildcat Drills Near 13,000 Ft.

With bottom last reported at 12,977 ft. in hard brown shale, the California Exploration Co.'s Calif. Land-Dougherty-Salisbury No. 1 is still making hole.

Thin, hard streaks of oil sand have been encountered in many zones but formation tests of them have proven unsuccessful. Chief reason for the unfruitfulness of the tests is the fact that the sands are too tightly packed to present a reservoir for oil accumulation.

Hope for the area lies in the deeper formations, which could offer looser and more productive sands to test.

Union Tests Aliso Well

With bottom at 5980 ft. and a liner cemented through perforations at 5760 ft., Union Oil Co. is making a production test in S. S. Orcutt No. 1 at Aliso Canyon. The well is located northeast of the discovery well, Porter No. 1, and appears to have intersected the control faults much lower.

Standard Oil Co. is drilling below 6700 ft. in H. R. Ward No. 1, a westerly offset to the union project.

Atlas Abandons Delano Wildcat

Atlas Petroleum Co. Moore No. 1, located six miles from the south tip of the Trico gas field, in sec. 7, 25-25, was abandoned at 3826 ft. after making a production test from the interval 3370-3382 ft. which recovered only salt water.

If the China Clipper flying from Alameda to the Far East were designed to operate on 100 octane fuel, each pay load would be increased by $2,000.

Three Drillers in Elk Hills Area

Drilling in the newly discovered Richfield-Western area near Elk Hills, the Richfield Oil Corp.'s Western No. A-12-33, an attempt to extend known limits easterly from present production in section 32, is drilling ahead in sand and shale below 5000 ft.

Sole production in the area belongs to Richfield Oil Corp. with two showing wells No.'s A-32 and 52, potential producing lands immediately surrounding are blocked up exclusively by Richfield and Standard.

Located a little more than a mile northwest of Richfield production, as near as intervening Richfield acreage will permit, Standard Oil Co.'s KCL No. 21-1, was last reported as drilling at 8414 ft. in hard gray shale. This is the only deep test ever made of the area, and only the second test of the entire area east of the city of Tupman and the westerly limits of the Ten Section field six miles away.

Standard Oil Co. has located a well in the Elk Hills field proper. To be known as Tupman No. 2-16, the well will be situated near the south quarter corner of sec. 36,30-24, in the midst of Standard Fee production.

Fresno City Wildcat Rig Is Built

Proposing to drill a wildcat five miles west of the city of Fresno, Seth Turner has built a rig on sec. 4, 14-19.

Richfield Prepares For Wheeler Ridge Test

Bottomed at 11,000 ft. in oil sand, the Richfield Oil Corp. is reaming KCL No. 1 to set casing at 10,830 ft. for a production test of the San Emigdio sandstone of the Oligocene Epoch. The well, located immediately south of Wheeler Ridge shallower production, in sec. 28,-11-20, produced an initial flow at a 1900 barrel rate from the Middle Miocene formations early in the year. Gas pressures failed however and water rapidly came in until in March the well was pumping only 89 barrels of oil cutting 36 percent.

Believing that better production underlaid the immediate area, Richfield instituted deepening operations from 9280 ft. on April 8th. Drilling operations showed only a little gas until the drill reached 10,578 ft., where the first deep oil sand was picked up.

In the interval 10,718-10,755 ft; the barrel yielded cores which were 75% tight, fine oil sand, and which was classified as the Oligocene, normally a coastal producing horizon. At 10,897 ft., medium to coarse oil sand was encountered which carried to bottom at 11,000 ft.

Results of the test will be carefully watched by all oil men as production from this zone would open a new valley drilling horizon.

Poso Creek Try Is Abandoned

Bailing for production in sec. 20,27-27, north of the Premier field in a much drilled area, and recovering only water, prompted the abandonment of Little & Gilstrap's Keating No. 2. The failure to find production adds one more to the many unsuccessful attempts made heretofore in the general area.

Two Mount Poso Tests Bailing For Production

Crestmont Oil Co.'s Buchner No. 1, located northwest of Dominion Pool production in sec. 20,26-28, is bailing oil and sand with the fluid level at 750 ft. Eight and five-eighths inch casing is cemented at 1530 ft. with 71 ft. of 6⅝" liner including 20 ft. of perforation landed on bottom at 1547 ft.

In the same general area on sec. 28, 26-28 Wright & Eyer's Well No. 1 is bailing mud and water with a trace of oil. The hole is bottomed in oil sand at 1512 ft. with 8⅝" casing set at 1500 ft.

Morton C. Lindley is preparing to spud KCL No. 14-1 in sec. 14,26-28.

KNDA Hits Avenal Sand In North Dome Well

Recovery of 44 gravity oil from a formation test of KNDA's well No. 54-24H, in sec. 24,21-16 at the most northerly tip of the field may lead to a big completion. Tubing is being run for a production test. The well, when completed, will be producing from the Avenal zone of the Eocene which is similar in age to the horizon productive in the Coalinga field.

The KNDA strike is only half a mile from the Lillis & Welsh well which was carried to a then world's record depth of 11,147 ft. to discover the zone, but with non-commercial results. It was due in part to the discovery of the zone by Mr. McAdams, operator of the Lillis & Welsh, and after whom the zone was originally named, that the Petroleum Securities started the exploration which led to the discovery of the Coalinga Eocene Pool.

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Wasco Well Completed

Standard Oil Co.'s KCL No. 8B-2, just south of production, in sec. 17,27-24, has been completed and shut in. With the tubing placed at 13,108 ft. the well was flowed to the sump until it cleaned up to 2% cut. Production figures are being held up until the well can be flowed to the tanks which are being built.

Northwest of the field George F. Getty is finishing rigging up Janssen No. 1. At the southeast corner of the township, in sec. 36,27-24 Union Oil Co.'s Kernco No. 1-36 is standing cemented with a 7" string landed at 12,787 ft. Bottom is given as 12,985 ft.

Round Mountain "Cat" Abandoned?

Pan May Oil Co.'s Kelly No. 2, located in sec. 31,27-29 and a northerly outpost of the Round Mountain field, may soon be abandoned. The well is reported to have encountered the barren Walker after drilling to 1500 ft.

San Emigdio Gets Third Test Project

With Continental Oil Co. KCL No. F-1 drilling below 2000 ft. in sec. 5, 10-21, and Shell Oil Co.'s Union No. 73-31 below 3500 ft. in sec. 31,11-22, the rigging up of Louis E. Bannow's No. 1 in sec. 15,10-23 gives three drillers surrounding the Rancho San Emigdio to the north and west.

Trico Gasser Is Capped by Standard

Standard Oil Co. T.G.&T. No. 2 which blew in flowing an estimated 20,000,000 cubic feet of gas has been capped and shut in. Standard has made location for an outpost gas try one mile north of production at the south end of the field. The well, to be known as Tulare Farms No. 1, will be located near the southwest corner of sec. 25, 24-23.

Los Angeles Basin

Rosecrans Outpost Cores Good Oil Sand

Apparently destined for a new and perhaps larger boom is the Rosecrans field. Howard Oil Associates' H. O. No. 1, located near the intersection of Compton Blvd. and Maple Ave., cored solid oil sand from 7604 ft. to bottom at 7644 ft.; a body thicker than any found within the field. The sand is described as being medium fine, soft, and well saturated. As the Miocene was topped at 7000 ft., somewhat lower than the nearest wells 1000 ft. to the north, and the oil sand appears different in character, it is assumed that Howard Oil Associates has found another productive block in the much faulted Athens-Rosecrans structure. Some geologists are inclined toward the theory that the sand in the new discovery is correlative with one of the lower Callender zones in the Dominguez field rather than with the more thinly stratified sands and shales of Rosecrans. Arrangements are being made to run casing and make a production test. Should production be obtained, as it seems probable that it will, an extensive new drilling boom will be launched.

Two more extensions are being made in other sections of the field. John Marion is completing his No. 2 as the most southerly well west of Figueroa St., and Wilshire Oil Co. is setting casing in Leitch No. 1, the most westerly well to seek O'Dea zone production. Both wells are expected to make satisfactory producers.

Bankline Oil Co. at last seems to have overcome the jinx following Kirby No. 1. The well has been redrilled to 7590 ft. and has cemented a 7 in. water string preparatory to drilling "in" and completing.

Completing Trust No. 15 in the interval 7590-7813 ft., Universal Consolidated Oil Co. obtained a flow of 280 bbls. a day of 32 gravity clean oil. The well is located in the westerly portion of the field.

Lower 7th Promises Big Montebello Wells

With the zones becoming increasingly more prolific with depth, the lower portion of the Seventh seems now to be the best yet uncovered in the West Montebello field. Pioneered by Union Oil Co., Graham & Loftus Oil Corp. and Wood-Callahan Oil Co. in the easterly section, the so-called fourth finger of the Seventh zone is now being tested to even greater penetration in the Maple Ave. area. Bottoming at 7633 ft., V-8 Oil Co. has cemented a liner through perforations at 7125 ft. and is preparing to complete. A formation test of the interval 7370-7475 ft. resulted in a strong gas flow and the recovery of a small quantity of light condensation oil.

Following V-8's lead are Pongratz Petroleum Co.'s Newmark No. 1, Montebello Wesco, Inc. No. 1 and Montebello Reservoir Oil Co.'s No. 2; all scheduled to be bottomed at approximately 7625 ft. On formation test of the middle Seventh zone interval 7230-7360 ft., the Pongratz well is said to have flowed clean oil at the rate of 1000 bbls. a day.

The completion of good wells in the deep zone by Graham & Loftus and Wood-Callahan near the intersection of

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Inglewood	Vanguard Oil Co., L.A.I.	1	29, 2-14		Rig
La Mirada	John McKeon and Assoc. Carmenita	1	21, 3-11	8990	Abandoned
Montebello, West	Ridge Oil Co., Sea Cliff	1	3, 2-12	6464	Drilling
Newhall	Mangrum and Page, Lintz	1	4, 3-15	390	Idle
	Palmluck Oil Co.	1	23, 3-16		Rig
Palmdale	New-Cal	1	17, 6-12	1250	Idle
Palos Verdes	Rolling Hills Pet.	1	27, 4-14	5385	Idle
Playa del Rey	Empire Oil Co., Samarkand	1	34, 2-15	6168	Drilling
Puente	Stabeck & Assoc.	1	14, 2-10		Rig
San Pedro	Grady, R. T.	1	23, 5-14	650	Idle
Sunland	South Alta Oil Co.	1	1, 2-15		Rig
Towsley Canyon	J. E. O'Donnell	1	8, 3-16	4850	Drilling
Whittier	Langstaff, Geo. W., Iliff	1	8, 2-11	2250	Idle
	H. C. Oil Co., Joyce	1	22, 2-11	3600	Idle
	C. W. Partridge, Hillside	1	22, 2-11	1780	Cleaning out
	Taylor Drlg. & Prod. Co. Gregg	1	17, 2-11	3237	Drilling
	Vulcan Oil Co., Drake	1	17, 2-11		Location
	Orange County				
Costa Mesa	A. V. Oil & Gas Co.	1	16, 6-10	4751	Idle
Dana Pt.	Dana Point Oil Assoc.	1	15, 3-8		Cellar
Kraemer	Congress Oil Co.	2	36, 3-9		Foundation
Seal Beach	Union Oil Co., Nieto	1	12, 5-12	7101	Abandoned
	San Bernardino				
Carbon Canyon	Carbon Canyon Oil Co.	1	30, 2-8		Rig

6th St. and Lincoln Ave. has stimulated activity to a new high pitch in the easterly section. New projects are underway by The Caminol Co., John McKeon & Associates, Wood-Callahan, Mission Oil Co., Beverly-Montebello Oil Co., Star Petroleum Co. and others. Union Oil Co. is starting four new wells on its large La Merced lease.

New life for the extreme westerly sector was guaranteed by the recent completion of Olds No. 1 by Bush Oil Co. With 140 ft. of the Seventh zone open to 7191 ft., the well was swabbed in flowing 700 bbls. of clean 35 gravity oil daily. Production, now beaned to 300 bbls., is accompanied by 260,000 cu. ft. of gas. The company has moved equipment one location to the west and is drilling Alouzet No. 1. Other operators holding offset properties are expected to start work in a few days.

Hathaway Oil Co.'s Dore No. 1, discoverer of the Seventh zone and only well yet drilled south of Beverly Blvd., is being rigged up to deepen from 7181 ft. Completed last fall with the relatively small initial of 400 bbls., production had declined to about 75 bbls. a day.

Small upper Seventh zone production was obtained by Standard Oil Co. in Whitehead Community No. 5. With bottom at 7185 ft., the well was completed for 300 bbls. of oil and 200 bbls. of water. It is probable that steps will be taken to locate and cement off the water.

Stanley Oil Co. seems to be out of the woods with the hard luck hole, Montebello No. 1, at the northwest corner of Beverly and Maple. The hole has been redrilled almost to the old bottom of 7018 ft.

Kern-St. Helens Properties recompleted Monterey No. 30 as a two zone producer, production gauging 250 bbls. from the Sixth and 750 bbls. from the Seventh. The company is attempting to complete Monterey No. 28 in the third finger of the Sixth zone. Seventh zone tests are being made in Eggleston No. 2 and Taylor No. 2.

A recent upper Seventh zone completion was Union Oil Co.'s Wilcox No. 2, which, bottomed at 7160 ft., flowed 415 bbls. of clean oil and 1,100,000 cu. ft. of gas.

With the westerly development now a year and a half old, close observers of the field believe the peak of activity has not yet been reached. Significant are the facts that no dry hole has yet been drilled, and that each new deeper zone has not only been more prolific but has covered a wider area than its predecessors. Engineers are confident that an Eighth zone will be found productive throughout the field.

Torrance Hot Spot Now Is Very Cold

Collapse of the Torrance boom has been well-nigh complete, there being only three active projects in the erstwhile hot spot. Forced by his contract with the Shell Oil Co., D. W. (Walt) Elliott is deepening the old Kettler No. 8 east of Walnut Ave. near 235th St. South of 235th St. on the east side of Eshelman Ave., Domineaux & Jackson are drilling the well first known as Caltor Petroleum Co. Present depth is approximately 4300 ft. A block to the north on the west side of the street, Packard Drilling Co. is preparing to drill a new well.

On its large Kettler lease, Chanslor-Canfield Midway Oil Co. is redrilling and deepening No. 12. The well is located north of the late active area.

South of the intersection of Hawthorne and Sepulveda in the western end of the field, World Petroleum Corp. deepened the old Standard Oil Co. Currier-Flint No. 2 to 4873 ft., encountering the schist at 4812 ft. Casing has been cemented at 4610 ft. for a production test.

In the Harbor City extension area, General Petroleum Corp. plugged Poggi No. 13 from 5192 to 5170 ft. and recompleted with a 150 bbl. flow of 29 gravity clean oil.

North of an easterly extension of 255th St. and east of Vermont Ave., J. E.

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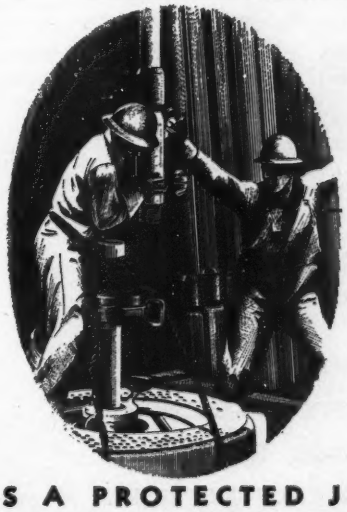

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O'Donnell is preparing to drill his well No. 72. It is Jim's first venture in the field.

Many New Wells Started In Long Beach Harbor

After fighting red tape for more than a year, the Long Beach Harbor Commission is now attempting to make up for lost time. With three wells now being completed, and another nine being drilled, the commission has ordered its operator, Long Beach Oil Development Co., to start at once on ten more. It is probable that drilling will be ordered on the "W" parcel, located west of the harbor entrance, within a short time.

Signal Oil & Gas Co., developer of the inner harbor channels, is completing CD Nos. 1 and 2 whose surface locations are on the Universal Consolidated Oil Co. Newport lease. Both wells are bottomed in the lower Terminal zone.

An interesting well has just been spudded in by Petroleum Midway Co. north of Anaheim Blvd. near the westerly city limits of Long Beach. The well will seek production in the Ranger zone.

In the northwest Wilmington section, Macson Oil Co. is drilling a new well called Macson No. G-55-3. The company has had very good success with its Tar and Ranger zone wells in this area.

Total production of the Wilmington field remains at an unjustifiably high level, its 23,000 bbl. daily excess over its allowable accounting for more than half of the state's 43,000 bbl. average. Field production for a recent week averaged 89,560 bbls. a day.

Shallow Hole Dry Near Hawthorne

Somewhat surprised recently were oil scouts on finding a small rig operating near the intersection of Rosecrans and Cerise Streets, in the Hawthorne area. In the midst of an area where many wildcat tests have disproved the presence of oil nearly down to the top of the schist basement, a Los Angeles group drilled to 2100 ft. in the apparent hope of encountering production. Although the operators claimed the well to be a core hole for geological information, reports indicated the project was located by a "doodle-bug".

E. Huntington Beach Interest Increases

With rigging up under way on the Duchess well, interest in the east side of Huntington Beach is steadily increasing. Newest entry to the area is Reo Petroleum Co. which is planning to drill adjoining the Standard Oil Co. Surf lease. Like Duchess, Weaver Bros. are said to be planning the deepening of one of the old Standard Oil Co. Farnsworth wells.

In the Five Points sector, Thompson & Gieske recemented the water string in the old Dragon well but failed to obtain more than a trace of oil on a pumping test. Nothing else is active in the area.

Southwest Exploration Co. maintains a steady pace in the development of the State tidelands, with two strings of tools running. Latest on production was No. 15; Nos. 16 and 18 are drilling and rig is up for No. 19.

Derrick Erected For Puente Test

In sec. 14, 2-10, three miles east of Puente, a Mr. Stabeck is reported to have erected a rig for another test of showings encountered by the old Rio Hondo and Vega wells. Although the old wells produced a quantity of oil over a long period of time, the rate was never commercial and the yield contained a high percentage of water.

McKeon Abandons Carmenita Project

After standing idle for several months, John McKeon & Associates' Carmenita No. 1, located on Firestone Blvd. east of Santa Fe Springs, has been abandoned. A series of production tests revealed the presence of a small quantity of gas but no oil. At one time a strong water flow was encountered. Total depth of the hole is reported to be 8990 ft.

Whittier Wildcat Drills Below 3250 Ft.

Taylor Drilling & Producing Co.'s Gregg No. 1, located on the north side of Beverly Blvd. west of Workman-Mill Road is drilling below 3250 ft. Formations thus far, have given no promise of oil production, the only showings being colors on the ditch at 2200 ft. The well is close to old production in the Rideout Heights field.

Mechanical Trouble Slows Towsley Well

Deepening operations on J. E. O'Donnell's Towsley Canyon well have been slowed of late by mechanical trouble with the drilling equipment. Several days were lost in recovering a drill pipe fish, and at last reports, the rig was being repaired. Total depth of the hole is 4850 ft. The well is being deepened by Mr. O'Donnell after being completed at a shallower depth last year as a small pumper.

Aircraft fuel production can be increased 15 times above normal requirements with a new refining process recently perfected.

Coastal District

Deep Test Seen For Bicknell Area

Some months after concluding a core-holing program, Hogan Petroleum Co. is said to be preparing to drill a deep test of the Bicknell area, near Orcutt in Santa Barbara county. The new well will be drilled near the site of Zabala Core Hole No. 1 which was located in sec. 33,9-34. Production will be sought in the Monterey shale series and Vaqueros sand sections of the Miocene.

Sun-Bell Plans Lompoc Driller

Sun-Bell Oil Co., a new company backed by Los Angeles capital, has erected a derrick to drill a well at the west end of the old Lompoc field. Location of the project is in lot 5 of sec. 28,8-34, adjoining old wells of the Union Oil Co. In charge of field operations of the company is Jack Listle, who is now a resident of Lompoc.

Bolsa Chica Resumes Piru Operations

After an extended period of idleness, Bolsa Chica Oil Co.'s Snow No. 4 is again active at Piru. Located in sec. 4,4-18, the hole was originally drilled to 4585 ft., later being plugged to 3535 ft. The well is cased to the top of the plug, 9 in. being cemented at 3025 ft., below which is a 6⅝" perforated liner. At present, efforts are being made to locate the source of water which has become a serious problem.

Snow No. 4 was originally completed in October of 1936 pumping 300 bbls. a day with a 10% water cut.

Union Oil Re-Enters Santa Maria Valley

After months of inactivity in the Santa Maria Valley field, Union Oil Co. has spudded in well No. 5 on the Frank Vicente lease in the southwesterly portion of the proved area. The project is a northerly offset to Fred Cole's No. 18 which is located in the Paderewski Subdivision.

Protective Casing Set In Avenue Jinx Well

After safely redrilling to the old bottom at 7899 ft., British American Oil Producing Co. has at last cemented casing in Hartman No. 7, the Jinx well of the Ventura Avenue field. The pipe will serve a dual purpose, it being both a protection string to keep the fish from falling back in the hole and a water string over the Barnard zone discovered by General Petroleum Corp. last fall. With 8⅝" casing cemented at 7870 ft., the well will be carried down to 8500 ft. zone where Alliance Petroleum Corp. recently finished Hisey No. 3 flowing 2080 bbls. a day.

With the fish sidetracked at 9500 ft., Lloyd Corp. No. 2, easterly outpost well, cemented a string of 7" casing at 9497 ft. to protect the hole. Re-drilling will be resumed immediately to explore below the former bottom of 9815 ft..

Still the leader in activity is Tide Water Associated Oil Co., which at the present time, has seven projects working. One of the most interesting is Ventura Land & Water No. 40, which is coring good looking oil sand below 10,200 ft.

Shell Oil Co. has two wells drilling and is testing for production in Edison No. 33 which has encountered some water trouble.

Continental Drills San Miguelito Well

Continental Oil Co. is drilling Grubb No. 11 below 5650 ft. in the San Miguelito field. Preliminary work is underway for No. 12 whose location required a great deal of grading and road building.

In the Padre Canyon sector, Chanslor-Canfield Midway Oil Co. is fishing drill pipe in Hobson No. A-7, bottomed at 5745 ft. The company has chosen the locations for numbers 3 and 4 on the Oakgrove lease.

San Marcos Core Hole

Richfield Oil Corp. is yet drilling its core hole, San Marcos No. 1 in sec. 20,6-29. When last reported, bottom was in hard shale at 1880 ft.

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NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Merced	Stone, Elmer B.	1	8, 12-11		Location
Monterey	The Texas Co., Arroyo Seco	1	11, 19-15	3600	Drilling
Solano	Standard Oil Co., C.P.C.	1	15, 5-2		Rigging up
Sutter	Buttes Oilfields, Inc.	5	1, 15-1	1650	Drilling

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
Santa Barbara County					
Bicknell Area	Hogan Pet. Co.	1	33, 9-34		Location
Capitan	Litho Oil Co., Rhode I.	1	4, 4-30	3015	Idle
Carreaga	Barbara Pacific Oil Co.	A-A 2	8, 8-33	6820	Drilling
Foxen Canyon	Richfield Oil Corp., Tinaquaic	1	36, 9-32	5541	Idle
Gato Ridge	The Pertol Corp., Tog.	32-A	9, 8-32	3100	Redrilling
Goleta Gas Area	Gen. Pet. Corp., More	4	15, 4-25	3581	Drilling
Guadalupe	Cole, Fred Ferrini	1	15, 10-35	4320	Drilling
Orcutt	O. C. Field Gas. Corp.	1	21, 9-33	5898	Drilling
	So. Calif. Drlg. Co., Houck	1	9, 9-33	5002	Bailing
Lompoc	Sun Bell Oil Co.	1	28, 8-34		Rig
Los Olivos	United Western Oil Co.	1	15, 7-30	3790	Drilling
San Marcos	Richfield O. Corp.,San Marcos	1	20, 6-29	1865	Drilling
Summerland	Garman Oil Co.	17-1	22, 4-6	1487	Idle
	Glenray Oil Co., Glenray	1	1, 4-26	90	Idle
	Oil Group, Inc., Hyland	1	16, 4-26	1315	Idle
San Luis Obispo County					
Elk Horn	Calif. Pet. Prod., Irons	1	19, 10-24	2265	Idle
	Newton, S. M., Stafford	1	18, 31-21	2636	Idle
	Temblor Oil Co.	1	22, 31-21	3465	Idle
Paso Robles	Epco., Inc.	1	27, 26-13	5325	Drilling
Ventura County					
Red Mountain	Martin, J. W.	3	15, 4-21	1610	Drilling
Sespe	English, J. A.	2	13, 4-19	1410	Drilling
	Merchants Pet., Cochran	8	1, 4-20	1910	Idle
	Nevada-Fortuna Oil Co.	1	13, 4-19		Rig
	Renard Oil Co.	1	6, 4-19		Rig
Shiells Canyon	Galveston Oil Co.	1	5, 3-19	3140	Idle
	Shomy Oil Co., Shomy	1	32, 4-19	825	Idle
Simi	Levesque, G. M.	1	17, 2-18	1775	Drilling
Tar Creek	Section 20 Oil Co.	1	20, 5-19	2818	Drilling

Walter Swaney, general manager of Kerotest Manufacturing Co., left, is discussing the business outlook with Joe Swaton, Kerotest Pacific Coast representative.

Kerotest Official Pacific Coast Visitor

Walter Swaney, general manager of Kerotest Manufacturing Co., returned recently to the home offices in Pittsburgh, Penna., after his annual visit to the Pacific Coast. Mr. Swaney was accompanied by Mrs. Swaney a highly fortunate circumstance because of a sudden illness which sent Mr. Swaney to the hospital where an operation was performed shortly after his arrival in Los Angeles.

Fully recovered before his departure, Mr. Swaney reviewed extensively the California situation with Joe Swaton, Kerotest Pacific Coast representative.

Oil Country Specialties Establishes Export Department

W. P. "Bill" Turner, president of Oil Country Specialties Manufacturing Co., has announced the establishment of an Export Sales Department at the Pacific Coast Plant, 2340 Artesia St., Long Beach, Calif. The new department will be equipped to serve all export fields, with special facilities for marketing in South American countries.

The new department will be headed by W. A. Loomis, a member of the O. C. S. organization for the past nine years. Mr. Loomis is widely known as the inventor of the O. C. S. Automatic Driller, a power unit for automatically controlling drilling weight.

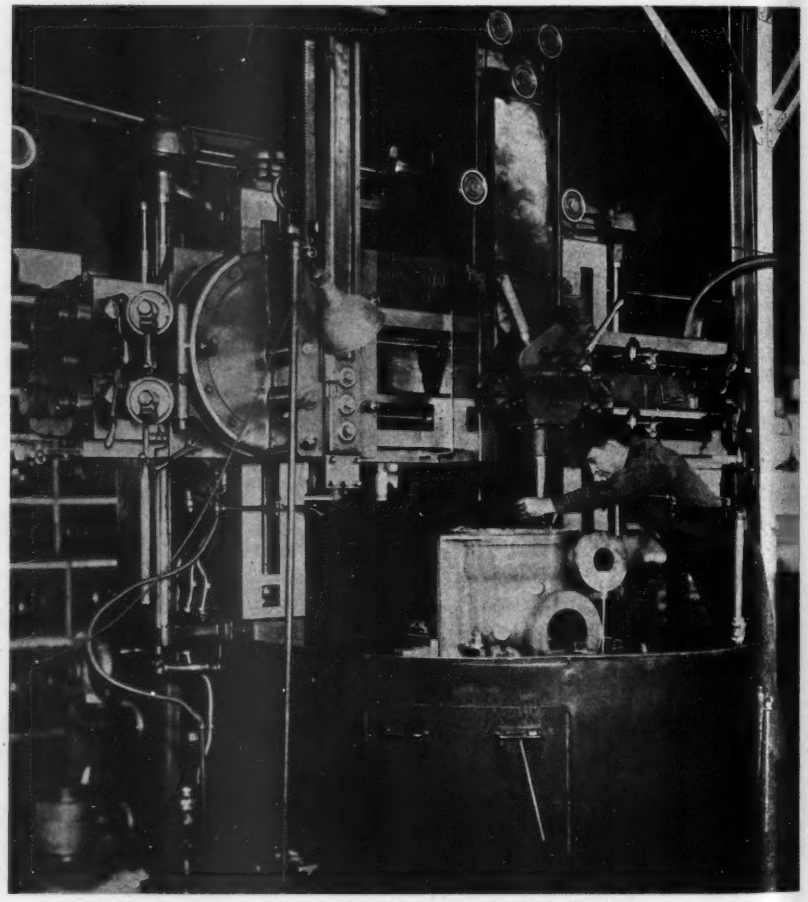
Lew Cline, former representative for the Titusville Iron Works, and now with O. C. S., recently left New York on a two months' trip to South America for the company. He will visit Venezuela, Colombia and Trinidad, making an extensive study of the equipment market in the interest of the new Export Sales Department. Prior to his affiliation with Titusville Iron Works and before coming to O.C.S., Mr. Cline was District Manager in Wyoming for Continental Supply, and was also representative for that company in the Export Corporation.

Pacific Pump Works Doubles Production Slate

Recent large orders for both hot oil and boiler feed centrifugal pumps have nearly doubled the production schedule of Pacific Pump Works, according to George E. Bigelow, general manager. Pacific's new design, involving the use of mechanical and floating seals for high suction pressure, high temperature conditions, is claimed to be one of the contributing factors for mounting orders both in the United States and abroad.

Thousands of dollars of new equipment has recently been installed by Pacific to enable them to keep abreast of the demand.

When an Illinois farmer struck oil recently he bought seven automobiles, one for each member of the family except the baby.



Boring Operation on 3" O. V. Solid Shell Pump Case, Pacific Pump Works, Huntington Park, Calif.

Cameron Iron Works Appoints Howard Supply

The appointment of Howard Supply Co., Los Angeles, as its California distributor has been announced by Cameron Iron Works, Inc., Houston, Texas, pioneer manufacturers of drilling and completion control equipment, and oil field specialties. Suitable stocks of Cameron materials will be maintained in Los Angeles, available for withdrawal by established supply companies. Service will be rendered by the Howard Supply Co.

R. G. Foreman, member of the Sales Staff of the Howard Supply Co., has returned to Los Angeles after spending four weeks familiarizing himself with Cameron equipment, and studying its application on deep, high-pressure wells in the Gulf Coast of Texas and Louisiana. Mr. Foreman will concentrate on the presentation of Cameron products to California operators.

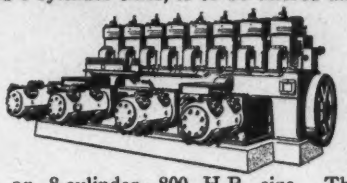
Roy N. Bean, sales engineer for Cameron Iron Works, Inc., has been assigned to the California territory for an indefinite period to cooperate with the Howard Supply Co. in introducing Cameron products to California operators.

Among the Cameron products which will be made immediately available to California buyers will be pressure operated blowout preventers and gate valves; manually operated blowout preventers; complete drilling and drilling-in control hook-ups; casing heads and spools; tubing heads of several types; tubing packers; "Flex-Seal" mud manifold valves; and a number of specialties including special 2" needle valves for extremely high pressure work; bottom hole chokes, of the circulating type; and tapered tube expansion chokes for elimination of freezing at the well head on high gas-oil ratio wells.

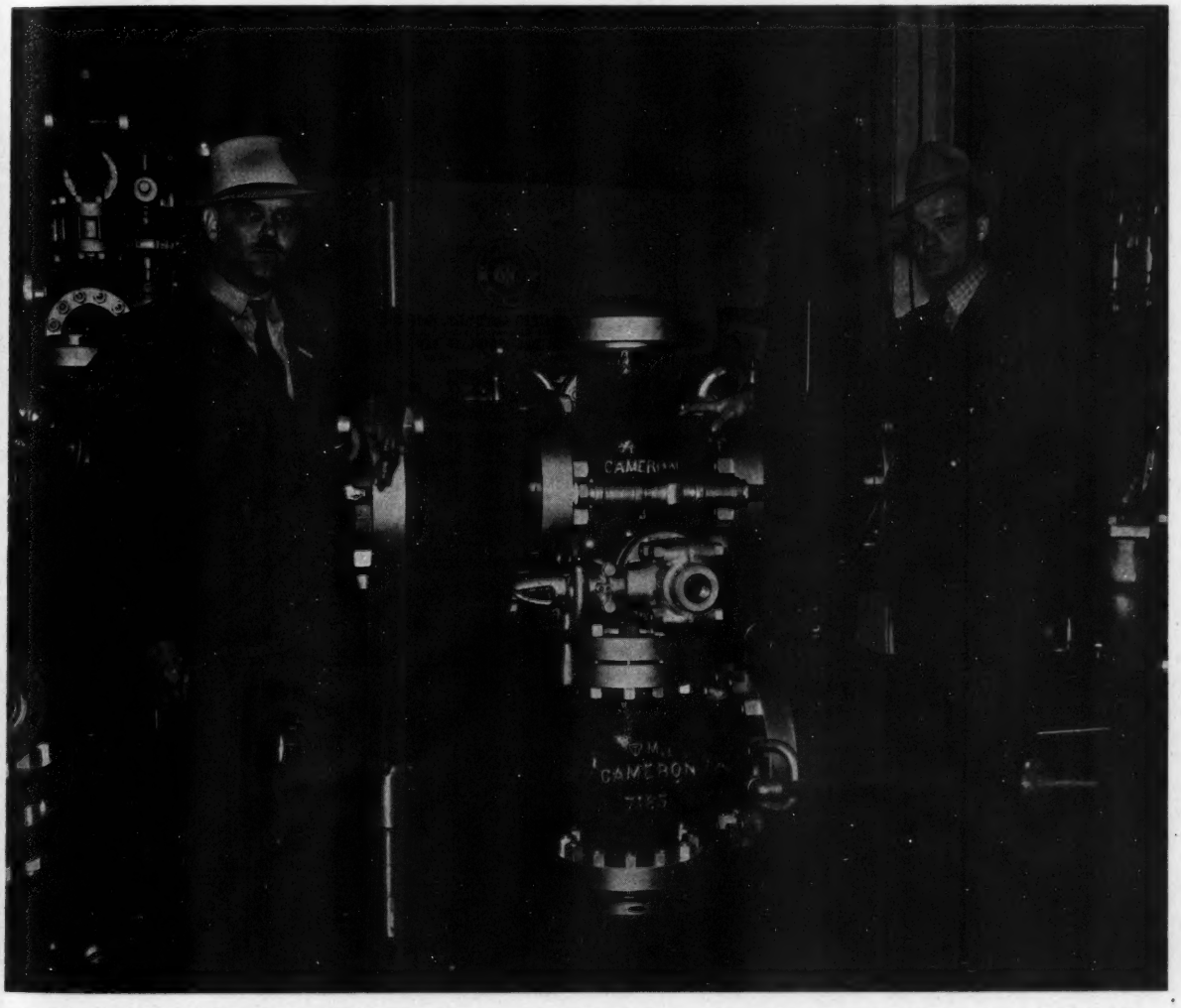
Petroleum company employees have 234 more credit unions than any other single group except federal employees.

Clark Bros. Co. 8-Cylinder "Angle"

Clark Bros. Co., of Olean, New York, have announced that their right angle compressor, built heretofore in 2, 3, 4, 5, and 6-cylinder sizes, is to be offered also



in an 8-cylinder, 800 H.P. size. This larger size is offered especially to meet a demand of the larger natural gas companies which have found the "angle" type of compressor especially satisfactory for booster station service. The 8-cylinder size, however, will be suitable for many types of service. Two of the 8-cylinder "Angles" have been sold to the M. W. Kellogg Co., of New York, to be installed in a Texas refinery. It is stated that with the new 8-cylinder angle it will be possible to install a 3,200 H.P. Gas Booster Station in a floor space 24x105 feet.

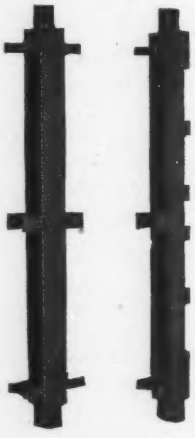


Roy N. Bean (left), Sales Engineer, representing Cameron Iron Works, Inc. on the Pacific Coast; and R. G. Foreman of The Howard Supply Co. which was recently appointed California distributors for Cameron equipment.

W. B. Holton, Jr., president, and J. M. Olmsted, vice president, of Walworth Co., Inc., on a recent field trip inspecting the Walworth Christmas Tree installations at the new Coalinga field.

Inferno Introduces "Tailor Made" Gauge

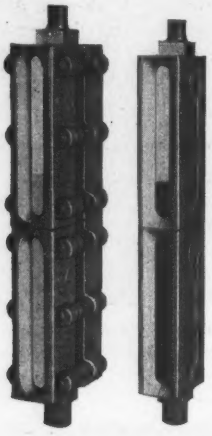
A new gauge for separators, gasoline plants and refineries, with a one-piece fluid channel any length up to ten feet



Left: Core for a transparent type gauge, with channel bored straight through the bar of metal, and with lugs welded between the apertures to guide the glasses and clamps into correct position. In this case the customer ordered a male thread on one end and a female thread on the other.
Right: Core ready for reflex type gauge, with apertures cut through into the channel on one side only.

is announced by The Inferno Co., Shreveport, Louisiana. Bulletin No. 20 is available on the subject. This new "tailor made" gauge can be either reflex or transparent, and is manufactured only on order and to specifications as to overall length and the threads desired on the ends. Quick operating clamps are used to hold the glasses in place, designed so that a glass cannot be accidently broken by applying too much pressure on any one screw when installation is made.

The one-piece core for this new gauge is made of navy bronze, steel or stainless steel, depending on pressures, temperatures and corrosive conditions. The core is bored from a solid bar of metal, and



Left: Transparent type gauge assembled.
Right: Reflex type gauge assembled.

apertures are then cut through into this channel over which gaskets, glasses and clamps fit snugly. Only one inch intervenes between visible sections.

The gauge conforms with A.S.M.E., A.P.I. and all other known requirements for equipment of this nature.

A. O. Smith Casing Book Gives Valuable Information

Men interested in drilling practices would readily buy the book on casing recently published by A. O. Smith Corp., Milwaukee, Wis., for free distribution in the oil industry. Among the topics covered are elements of casing calculations, collapse testing curves, ceiling for casing, efficiency of steel in casing, designing for pull-out, testing joints in casing, setting depths for pull-out, and setting depths for collapse of casing ranging from 5½-inch to 10¾-inch.

The book is announced as a new approach to the problem of collapse; a clearer picture of setting depths, and an announcement of stronger casing for deeper holes. Either engineer or layman will have no difficulty in understanding this simplified exposition of the fundamentals involved in casing design. A chapter deals with the method of utilizing the many graphs appearing in the book. For the use of engineers an appendix includes discussions of R. G. Sturm's equation, Lame's formula, and Poisson's ratio.

You are reading the Pacific Coast oil men's home paper.

Death Takes Two Standard Oil Men

R. H. Morrison

Born in Ellendale, North Dakota, May 22, 1896.

Mr. Morrison attended the University of California, entering that institution in September, 1912 and graduating in May, 1917 with an A.B. in Economics.

He served in the Army in France during the World War and after the Armistice he entered Sorbonne University, Paris, France where he studied for several months. Upon his return to the United States he re-entered the University of California in September, 1919, graduating in Law in May, 1921.

His first position with Standard Oil Co. was in the Land & Lease Division of the Producing Department as Assistant Superintendent of Titles. In June, 1924 he was transferred to the Los Angeles office in the same capacity. On January 1, 1925 he became a "Leaser" in the Los Angeles office in which capacity he served until July 20, 1925 when he became Superintendent of the Land & Lease Division with headquarters in Los Angeles.

In August, 1930, Mr. Morrison was made Manager of The California Co., a subsidiary of Standard Oil Co. of California, with headquarters in Dallas.

On July 1, 1936 he was made Vice-President and Director of The California Texas Oil Co. and of The Bahrein Petroleum Co., Ltd., which offices he held until December 31, 1938 when he resigned to re-enter the employ of Standard Oil Co. of California.

At the time of his death on May 14, 1939, Mr. Morrison was on an extended sick leave.

G. V. D. Marx

Born in San Francisco, May 27, 1900.

Attended grammar and high school and Stanford University from which institution he graduated in June, 1921 with an A.B. in Mechanical Engineering, and the following year in June he received his Engineer's degree at Stanford.

After graduation, Mr. Marx worked for the Shell Oil Co. at Long Beach as a Gas Engineer, remaining in that capacity until 1924 when he secured a position with the O. C. Field Gasoline Corp. of Huntington Beach, where he worked for about six months.

In December, 1925, Mr. Marx entered the service of Standard Oil Co. of California as an Engineer in the general Engineering Department. On September 1, 1929 he was transferred to the Producing Department as a Petroleum Engineer and on July 1, 1936 was promoted to the position of Assistant Chief Petroleum Engineer, which position he occupied until the time of his death on May 14, 1939.

Exhibit Model of New Youngstown Seamless Pipe Mill

A complete working model of The Youngstown Sheet and Tube Co.'s new seamless pipe mill, which actually pierces tiny metal billets and rolls them into miniature lengths of seamless oil country tubular goods, will be on exhibit at the Bakersfield store of The Republic Supply Co. May 31 to June 1 inclusive and in Conference Room No. 1 of the Los Angeles Biltmore, June 5 and 6. Exhibit hours will be from 2 to 5 and from 7 to 9 p. m. at both showings.

This model mill, which was shipped from Youngstown's plant at Youngstown, Ohio, will be exhibited under the auspices of The Republic Supply Co. of California, Youngstown distributors in the California oil fields.

The 3-ton model, 23 ft. long and 4½ ft. wide, is an exact duplicate of the actual mill, depicting the entire course of steel through the gigantic pipe-making machines. The miniature billets proceed on mechanical conveyors from unit to unit, just as in the real mill, without being touched by human hands.

Youngstown working model duplicates such pipe mill scenes as this, on a miniature scale.

So complete is the detail that the operating rolls are interchangeable and the piercing units are adjustable to different sizes and pitch. The model is built on a scale of one inch to the foot.

Starting from the two billet heating "furnaces" that faithfully depict the appearance of the big gas-fired chambers even to the flash of red light seen when the billets are discharged, the miniature billets move across conveyor tables to the inlet trough of the first piercer. Here the solid billet is passed through rolls which open it in the center and at the same time force it over a long rod or "mandrel."

The pierced billet, now a rough tube, is lifted out of the outlet trough and carried by a tiny conveyor system to the second piercer. Here the tube is passed again through a set of rolls, similar to those of the first piercer, which work the metal further, reducing the wall thickness. The tube is then carried across additional conveyor tables to the "high" or "plug" mill where it is further elongated by being passed back and forth between grooved rolls. The plug mill in miniature stands 14 inches high.

A marvel of ingenuity, the model was designed, fabricated and erected by men within The Youngstown Sheet and Tube Co.'s own organization. From the time the specifications and drawings of the big mill were received the model was built in 78 days.

The operating mechanism of the model, including a maze of compressed air lines and electric wiring, is all under the display table. A total of 6600 pounds of castings was used in the assembly.

This model mill has been shown at various expositions throughout America where it has attracted wide attention. It has been shown in New York City; Atlantic City; Cleveland, Ohio; Detroit, Mich.; Chicago, Ill.; St. Louis, Mo.; Tulsa, Okla.; Houston, Texas; and San Francisco, Calif. It has won prizes as the most informative exhibit in practically every show in which it has appeared where prizes have been awarded.

Gene McIntyre Adds Oil Well Supply Lines

Gene McIntyre, 727 W. 7th St., Los Angeles, has enlarged his sales agency of oil well supplies and mining and industrial equipment.

As Victaulic, Inc., Mr. McIntyre for several years handled the sale of Victaulic flexible pipe couplings exclusively, but is now augmenting his business with the following equipment.

Rector Well Equipment Co., of Fort Worth, Texas, with its established lines of Rectorhead and Rectorseal; W-K-M Co., of Houston, Texas, handling tubing spiders and slips, pipe straightening machines, twin-seat valves and W-K-M lubricated gate valves; Crutcher-Rolfs-Cummings, Houston, on W-K-M pipe cleaning machines and parts; also the Johns Manville pipe wrapping machine; Naylor Pipe Co., Chicago, with Naylor Lockseam Spiral-Weld pipe; The Inferno Co., Shreveport, Louisiana, with firing controls, oil and gas burners, gauge cocks, low water alarm and fuel cut off valves, various types of water gauges, including the new Clamp Type Reflex Gauge; Victaulic Co. of America, New York City, with Victaulic Flexible Pipe Couplings and Fittings.

For over twelve years Mr. McIntyre has been selling Victaulic Couplings,—originally with the Smith Separator Co. in Oklahoma, then with Ducommun Metals & Supplies in Los Angeles and later as Victaulic, Inc. Before returning to his native California, he was associated with the D & B Pump and Supply Co. and the W-K-M Co. in Texas. As a "youngster," Mr. McIntyre gained practical experience in the oil fields with J. F. Lucey Supply Co. at Los Angeles and Coalinga, the Continental Supply Co. at Caspar, Wyo., and the North Texas Supply Co., at Breckenridge, Graham and Ranger, Texas.

Tubbs Cordage Executive Is Taken by Death May 12

Friends of Stuart T. Henshaw, sales manager of Tubbs Cordage Co., will be sorry to hear of his death in San Francisco, May 12.

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Large maps of Los Angeles Basin oil fields and map showing all California oil fields. Price $15.00 each on paper and $20 each on cloth. Individual state oil and gas maps of Mid-Continent and Rocky Mountain regions. Maps show geological cross sections at base. These maps indicate wells drilling, wells producing and abandoned, with depths.
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Oil Men's Calendar

C.N.G.A. Meeting First Thurs. Each Month.

22-June 8—World Automotive Engineering Congress, sponsored by S.A.E. for New York (May 22-26), Indianapolis (May 30), Detroit (May 31-June 2), San Francisco (June 6-8).

Guadalupe Test Drills Below 4350 Ft.

With the bottom of the hole below 4350 ft., Fred Cole is refusing to divulge the formations encountered in Ferrini No. 1, wildcat well located near the town of Guadalupe in sec. 15,10-35. The well, which is backed by Hollywood money, is accorded an excellent chance of finding production in the Monterey.

Field Deepens Orcutt Well

Five miles east of Orcutt, and one mile south, O. C. Field is deepening his Corporation No. 1 at 5875 ft. in formations said to be Sisquoc. The project is located in sec. 21,9-33.

California Crude Oil Production

Two Weeks Ended May 13, 1939

	May Daily Quota	Average Daily Production	Excess
San Joaquin Valley			
Belridge—North	13,575	12,582	*993
Belridge—South	1,895	1,109	*786
Buena Vista	16,130	16,635	505
Canal	4,590	4,313	*277
Coalinga-East(Eocene)	4,778	5,381	603
Coalinga—East-West	15,397	6,910	*8,487
Edison	2,310	2,392	82
Elk Hills	7,185	9,770	2,585
Fruitvale	6,360	6,760	400
Greeley	1,810	2,059	249
Kern Front	7,335	7,025	*310
Kern River	5,800	2,430	*3,370
Kettleman No. Dome	52,310	53,481	1,171
Lost Hills	3,930	3,043	*887
McKittrick	3,675	3,535	*140
Midway	39,265	31,989	*7,276
Mount Poso	12,455	18,546	6,091
Mountain View	7,855	9,086	1,231
Rio Bravo	6,905	8,737	1,833
Round Mt. and Coffee Canyon	10,410	10,699	289
Ten Section	8,895	9,125	230
Wasco	1,060	909	*151
Other Fields	2,795	2,890	95
TOTAL	236,720	229,406	*7,314
Coastal Counties			
Elwood	4,040	4,355	315
Rincon	2,825	3,062	237
Santa Maria	5,795	2,986	*2,809
Gato Ridge	1,860	2,864	1,004
Santa Maria	18,035	10,717	*7,318
Santa Paula-Newhall	5,290	5,559	269
Ventura Avenue	29,865	33,485	3,620
Other Fields	5,310	5,283	*27
TOTAL	73,020	68,311	*4,709
Los Angeles Basin			
Alamitos-Seal Beach	6,760	6,868	108
Brea-Olinda	8,150	5,511	*2,639
Coyote—East	2,620	22,04	*416
Coyote—West	7,535	8,011	476
Domingues	17,260	21,362	4,102
El Segundo	3,100	3,381	281
Huntington Beach—New and Old	24,060	28,465	4,405
Inglewood	11,680	11,706	26
Long Beach	39,550	48,718	9,168
Montebello	5,710	5,747	37
Montebello-West End	5,615	11,850	6,235
Playa del Rey	4,680	5,115	435
Richfield	7,180	8,121	941
Rosecrans-Athens	9,425	13,352	3,927
Santa Fe Springs	25,500	27,410	1,910
Torrance	5,651	5,667	16
Torrance "34" and "D & B"	13,064	16,782	3,718
Wilmington	66,810	89,513	22,703
Other Fields	3,250	3,873	623
TOTAL	267,600	323,656	56,056
STATE TOTAL	577,340	621,373	44,033

*—Shortage.